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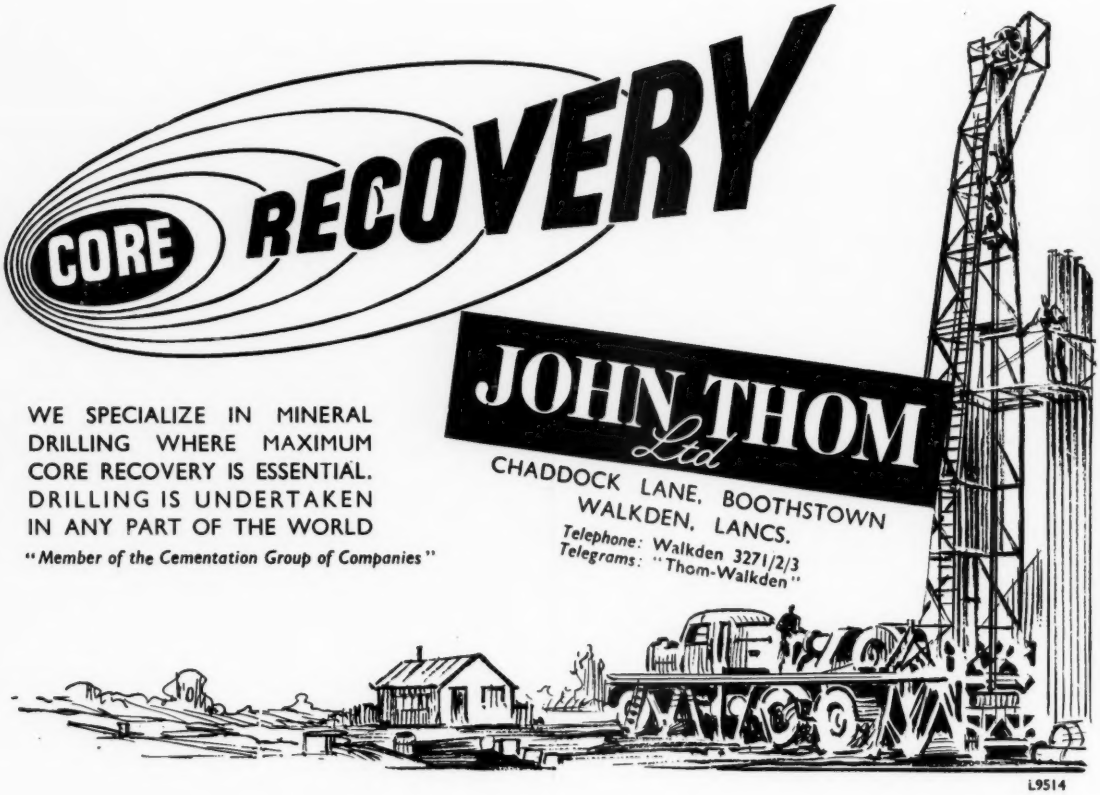

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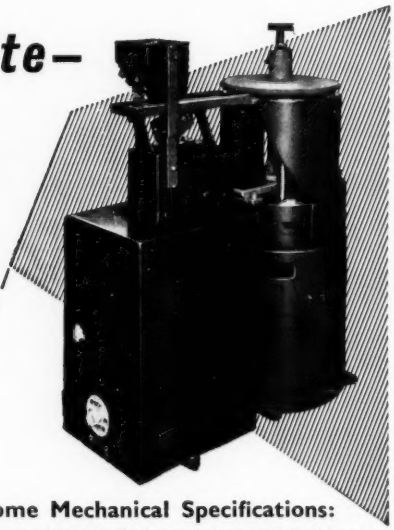

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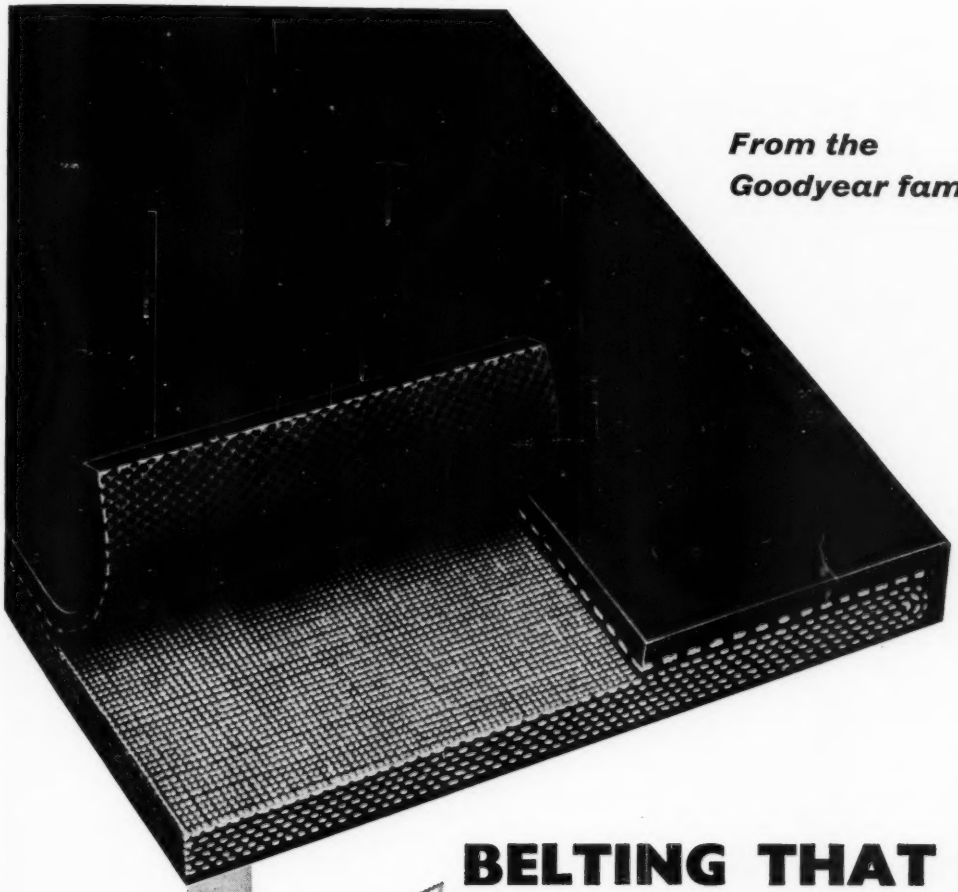

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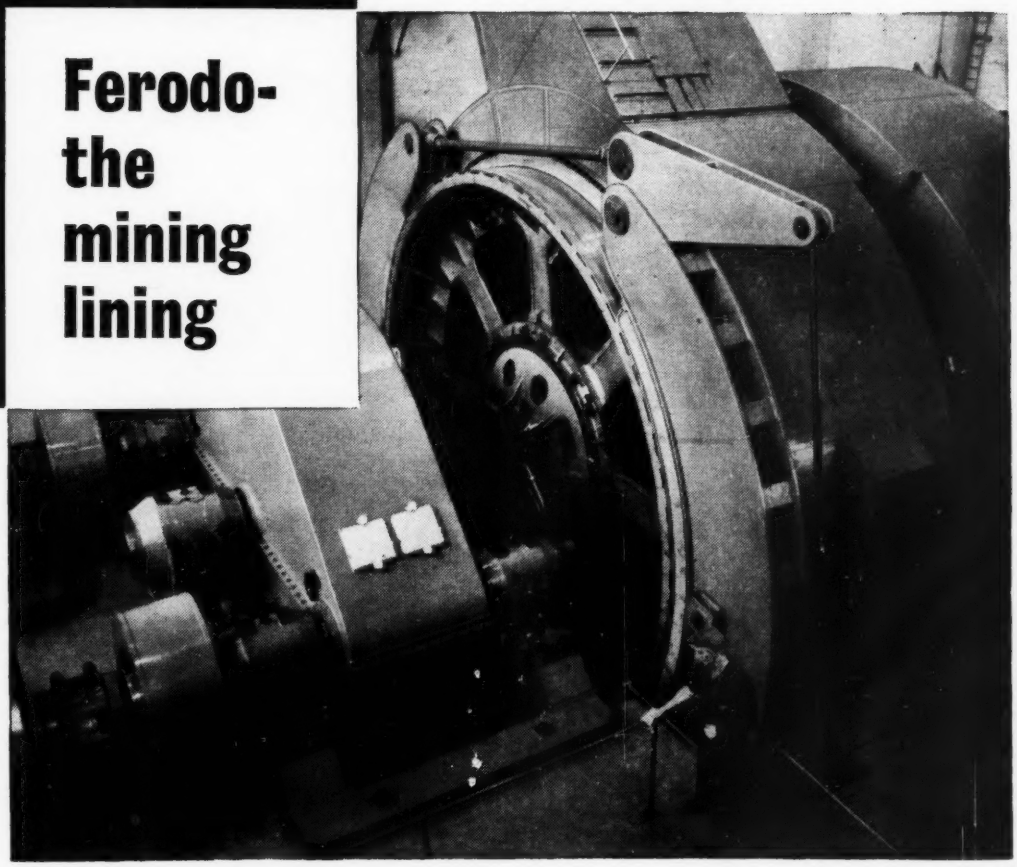

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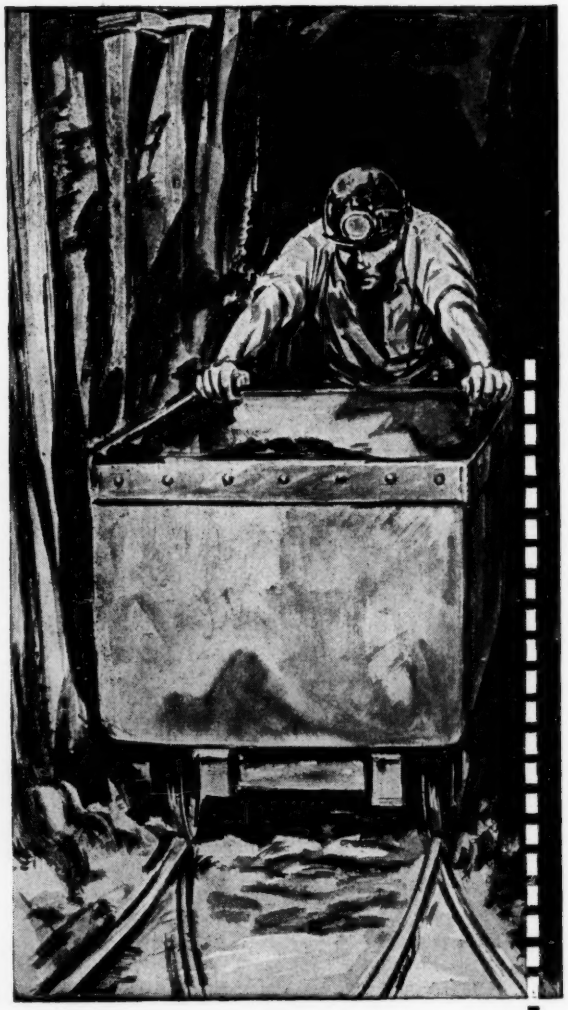

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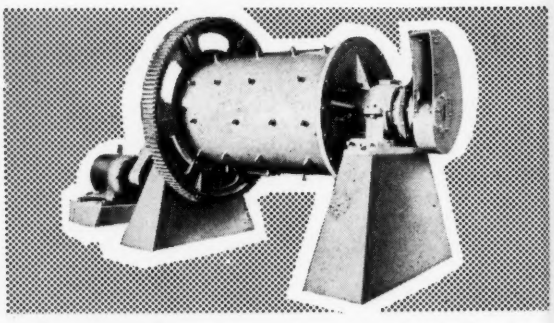

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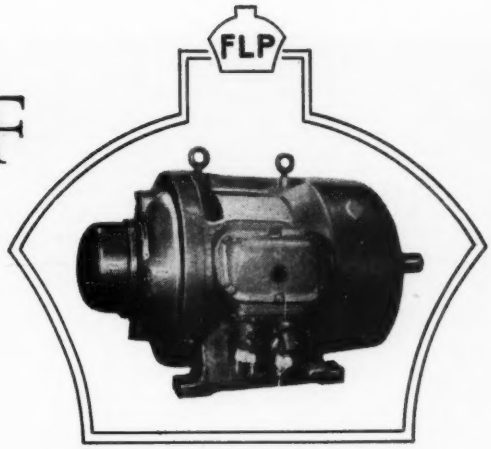

Top Left: *Totally-enclosed fan-cooled flameproof squirrel-cage motor, type KF.*
Top Right: *T.E.F.C. flameproof slipring motor, type FW.*

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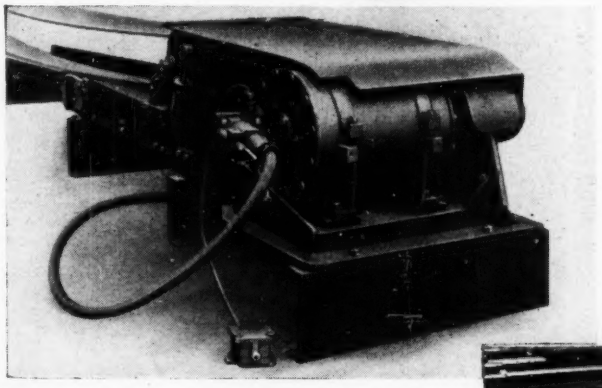

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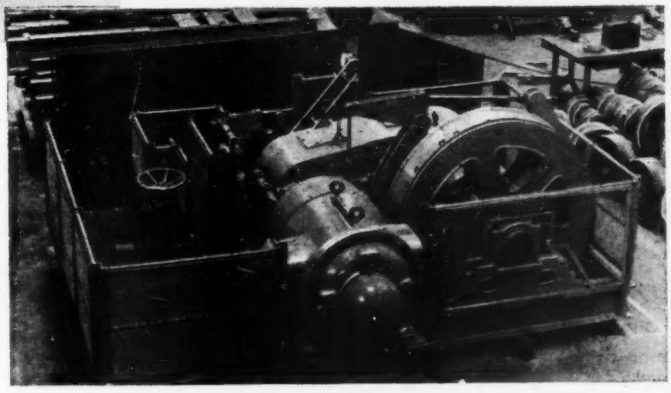
Above: *Type KF flameproof motor driving a "Huwood" conveyor.*
Right: *125 hp, 580 rpm totally-enclosed, fan-cooled, flameproof slipring induction motor driving Beckett and Anderson "Man-Riding" haulage for a colliery. Electro-hydraulic thrustor operating main brake is seen on left of motor.*



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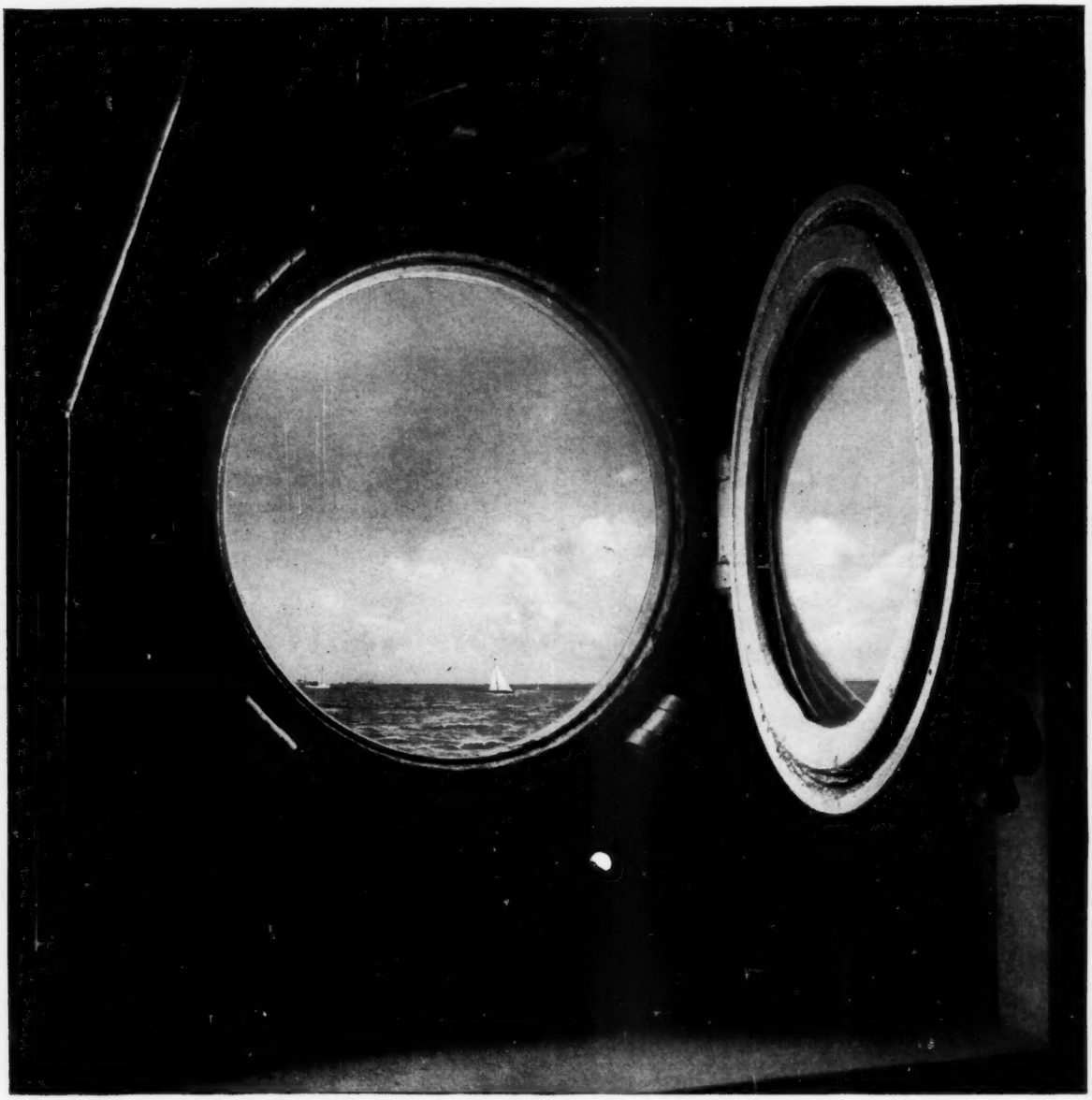

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The Mining Journal

London, January 1, 1960

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The Future of Tin Control

TIN producers must be viewing the current position and short-term outlook for their metal with a satisfaction which they have not been able to experience for some two years. However, it will take more than a few months of production at present quota and price levels for the declines in revenue of the recent past to be made good and for dividend cuts to be restored.

Meanwhile, it is difficult to see how the industry can hope to take a long-term view until the middle of this year, by which time it should have become apparent whether, and on what basis, a second tin agreement will come into force when the present one expires on June 30, 1961. A working committee of the I.T.C. is currently engaged on the problems inherent in a new agreement and its recommendations are due to come before the United Nations in May.

There seems little doubt that, whatever may be the shortcomings of the current agreement, it has manifestly resulted for producers and consumers alike in sufficient, if somewhat rough, justice to ensure that the present signatories will wish to continue with control for a further period. Thus even though it might technically be argued that the obvious condition of over supply, which existed when the first agreement was negotiated, no longer obtains, it seems most unlikely that this will be advanced from any quarter as an argument against a further agreement.

The principal obstacle to a workable new agreement remains (as with the present one) the fact that the world's largest stockholder and consumer on the one hand and one or two quite substantial producers on the other are most unlikely to be parties to it. There is no escaping the fact that the new agreement will have to be negotiated under the shadow of American stockpile holdings which are between 10 and 15 times larger than those which have been held by the buffer stock manager even at his moments of greatest embarrassment. Moreover, the agreement seems likely to have to be negotiated with no more specific safeguards regarding the freezing of the U.S. stockpiles than are being enjoyed during the life of the present agreement.

On the other hand, if not actually participating in the agreement herself, the States has in practice, at least lived up to her initial expressions of benevolent neutrality. Not only has she kept both her strategic and supplementary stockpiles in strict isolation, but she has in the past year gone some way towards strengthening the statistical position through barter offtakes totalling some 6,500 tons from the Congo, Thailand and Bolivia.

The fact is, of course, that the U.S. has, as great an interest in seeing the agreement work as has any of the signatories — no less in the interests of the continued economic prosperity of the underdeveloped areas from which comes the bulk of the world's tin than from a desire to safeguard herself against unduly high prices.

The extent to which the United States effectively influences the

operation of the agreement without being a party to it has been well illustrated in recent months by the buffer stock manager's care in preventing prices going above the £800 mark, which would appear to be the upper price limit to which American consumers will readily acquiesce. Unsatisfactory though all this may seem, U.S. support of the agreement has in practice been effective and there seems to be no reason to suppose that it will not prove equally effective in any future agreement, given a clear if tacit understanding regarding price levels.

The other major uncertainty overhanging any future agreement concerns the producers outside the agreement. Primarily this means Russia and China, although it should not be overlooked that other countries outside the agreement are between them producing some 10,000 tons a year and might well come to produce more. Indeed, it is doubtful whether, at the new quota level, the quota countries are producing more than 80 per cent of total world production. However, as the bulk of the remainder is produced behind the Iron Curtain, this is unimportant so long as either there is no exportable surplus from the Iron Curtain countries or, if there is a surplus, it is released at a predetermined rate.

The I.T.C. cannot reasonably object to Russia exporting to the extent that she has over the last couple of years, but it has had very good reason for objecting to not knowing in advance what tonnages were likely to be offered. Whether or not there was a period in 1958 when Russian tin was being mischievously released on world markets as a cold war gambit, Russia has no doubt come to realize that if continued, non-cooperation with the I.T.C. might well prove costly in terms of lost goodwill among the peoples of the main producing countries. Certainly she appears to have held to her export undertaking this year and the present East-West political climate gives no ground for greater fears in the immediate future.

Indeed, if the I.T.C. is prepared to negotiate another agreement with the States serving as a flying buttress rather than as a pillar of the church, it is practically impossible for Russia not to be accepted in similar manner and in similar good faith. If, moreover, good faith is assumed, then the fact that China must remain outside the agreement, so long as she has no standing in U.N.O. is of little significance as China can scarcely yet have progressed to the point where she could consider waging economic war on the West in isolation even if she wished to do so.

Aside from the difficulties of framing a watertight agreement without the participation of the world's two major powers, there are a number of points about the working of the agreement itself which may well be modified in any future agreement. Two of these relate to the conditions imposed on the buffer stock manager regarding the price levels within which he either shall, shall not, or may operate.

In the first place the influence of the upper *tranche* within which the buffer stock manager should have been a seller at his discretion, has been rendered ineffective in consequence of the I.T.C.'s efforts to keep the price below £800. This in turn has only been made possible by permitting the buffer stock manager both to sell and (as would now appear from the present size of the stockpile) also to buy in the middle *tranche* in which it originally was envisaged that he would not be empowered to deal at all. A further pressing reason for enabling the buffer stock manager to operate in this middle *tranche* was the need for converting back into cash part at least of its very large stockholding of a year ago. Nevertheless, if the tin market is to retain any genuine freedom of operation, it does seem essential that the I.T.C. should first make up its mind what the effective ceiling and floor prices are to be, and then set the three *tranches* within these limits.

The circumstances which brought about the surfeit of buffer stock tin and the near bankruptcy of the whole scheme focuses attention on another aspect of the buffer stock manager's terms of reference, which must be engaging the attention of the working committee. Looking back there seems little doubt that in the latter half of 1958 the buffer stock manager was the victim of a large amount of speculative selling which would never have taken place had he not been compelled under the terms of the agreement to continue to support the floor price until his funds ran out. It is obviously desirable that the buffer stock manager should come in as a firm buyer or seller respectively below or above floor and ceiling price levels, but it does look as if he should at the same time be provided with some escape clause to protect him against a repetition of this kind of irresponsibility.

Beyond this, it is essential that any new agreement should be framed so as to permit of immediate and complete continuity in operation both of the quota machinery and the buffer stock manager's operations. This point should be obvious enough, but it does seem necessary to re-emphasize it in view of the confusion which has existed about the interpretation of Article VII regarding the operation of quotas in relation to buffer stock levels below 10,000 tons.

We discussed this confusion in our leading note of September 11, 1959, and now it is perhaps only necessary to add that it is unfortunate that this, or any other figure, was ever written into the agreement. Had the I.T.C. been free to introduce quota control at its discretion, the impact of this would certainly not have been so sudden and it is probable that the buffer stock manager would have been spared the worst of his difficulties.

One other major problem, which must be engaging the attention of the working committee, is the redistribution of quotas in any new agreement. Present quotas are based on a formula agreed when the productive capacity of the various producing countries was somewhat different to what it now appears to be. Will Malaya or Nigeria, for example, agree to a perpetuation of quota allocations based on Annex A to the present agreement when countries such as Bolivia or Indonesia may even be hard put to it to meet their current quotas in full ?

By July we shall presumably know whether we are to have another agreement or not. If we are, and on the arbitrary assumption that Iron Curtain exports will continue at the 1959 rate, then the current quota level (equivalent to 144,000 tons a year) plus 10,000 tons from other western countries plus 13,500 tons of Iron Curtain exports should theoretically provide 167,500 tons for free world consumption. This is a few thousand above the 160,000 tons, which in some quarters is the present tentative estimate of 1960 consumption, although if the upward consumption trend of 1959 is continued through the coming year this may well prove to be an underestimate.

If, on the other hand, a new agreement is not negotiated, there is then a matter of twelve or thirteen thousand tons of buffer stock holdings (if we include U.K. Government stocks recently released), which will in due course have to be absorbed. This, however, need not prove any particular embarrassment. In the first place the present agreement will still have a year to run from next July and in the second place the agreement does not require the buffer stock manager to complete post-agreement liquidations until June 1962.

Any suggestion that the I.T.C. has been premature in raising quotas to 36,000 tons in the face of a possible failure to negotiate a fresh agreement thus appears ill-founded. Whether producers, who may be inclined to take a pessimistic view of the chances of a new agreement, will in fact increase production to meet these higher quotas or whether they will elect first to run down their mine stocks is of course another matter, and it may well be that producers who have room for manoeuvre may prefer to postpone any decision about the reopening of mothballed production facilities until the outcome of the U.N.O. meeting is more predictable.

PROGRESS OF THE BRITISH GEOLOGICAL SURVEY

The basic task of the Geological Survey of Great Britain is the preparation of up-to-date geological maps. In its report for 1958, the last year of the period covered by the five-year allocation, the Geological Survey Board reviews the progress of field survey in recent years. The total area covered by primary survey during the current quinquennium was 1,721 sq. miles, which compares with 1,197 square miles in the preceding five years; progress in revision survey was maintained, the total areas covered being 1,458 and 1,436 sq. miles respectively. The report emphasizes the importance of making more rapid progress in both primary and revision survey.

In its annual report for 1957 the board expressed regret that it had been found necessary to reduce the expected allocation of additional non-industrial staff to the Geological Survey and Museum and it urged that the full allocation should be restored before the end of the current quinquennium. It is, therefore, very satisfactory to record that the total allocation for the five years will be 64, giving a complement at the end of the period of 284—only one less than had been anticipated.

The board also records that the recruitment of suitably qualified geologists has been less difficult during the last two years than at any time since the war; for example, of the 23 appointed in 1957 and 1958, 18 had post-graduate research training. The recruitment of other grades of staff has also been rather less difficult but it is practically impossible to secure trained cartographical draughtsmen, and much time has to be devoted to training young entrants.

The amount of exploratory boring in Britain has been a striking feature of the post-war years. During 1958, however, the number of notifications of intention to sink boreholes and shafts under the various Acts concerned was less than for some years. The footage of strata examined was also less, but even so it exceeded 200,000 ft.

The Geological Survey has continued to use geophysical methods of investigation, for example gravity measurements, while borehole logging with electrical resistivity equipment in the chalk was found useful in a hydro-geological survey. The airborne magnetic survey in the north of England and the airborne radiometric and magnetic survey in the south-west of England were continued, the latter in association with the U.K. Atomic Energy Authority.

The Atomic Energy Division continued to act as geological consultants to the U.K. Atomic Energy Authority. A five-year reconnaissance survey has been implemented to establish the possible reserves of uranium in the United Kingdom; as a result, field studies by the Division have been confined mainly to Britain. Field investigations, however, have been undertaken in Bechuanaland, Sierra Leone, Ghana, Tanganyika, and in Southern Rhodesia.

NICKEL DEPOSITS IN PUERTO RICO

A report by W. L. Heidenreich and B. M. Reynolds (Bureau of Mines Report of Investigations 5532) describes the methods and results of field investigations conducted by the Bureau of Mines between December 1956 and December 1957 on seven deposits of nickel-cobalt-iron-bearing laterite and weathered serpentine near the west coast of Puerto Rico east and south of Mayaguez. These deposits were named, for purposes of identification, Guanajibo, Punta Guanajibo, Las Mesas, north and south deposits of the Rosario Southeast group, and the west and east deposits of the Maricao Southwest group. In addition, the lower 17 miles of the Guanajibo River Valley was tested at widely spaced intervals for possible concentrations of magnetite and chromite in the alluvial sands.

The objective of the investigations was to appraise, by drilling and sampling, the two largest deposits—the Guanajibo and Las Mesas. Testing of the smaller deposits was much more restricted. The work was financed jointly under a co-operative agreement by the Bureau of Mines and the Economic Development Administration, an agency of the Puerto Rican Commonwealth.

Drill-hole locations on the Guanajibo and Punta Guanajibo deposits conformed for the most part to a grid pattern of 800-foot squares.

Drilling in the laterite-serpentine deposits totalled 10,856.5 feet in 279 holes, from which 2,520 interval samples were taken. Drilling in the Guanajibo River Valley totalled 310 feet in 10 holes, from which 55 samples were taken. The inferred reserves of nickel-enriched laterite and weathered serpentine in the seven deposits, based on a cutoff of 0.6 per cent nickel, are 90,500,000 s. tons, with an average nickel content of 0.88 per cent. The average cobalt and iron contents are 0.09 and 23.2 per cent, respectively. The average thicknesses of the enriched zones range from 10.5 to 51, and the mean is about 19.5 feet.

STREAMLINING THE BELGIAN COAL INDUSTRY

Of all the European countries, Belgium has been hardest hit by the changing fuel pattern now affecting the various coal industries. Belgian mines have always been difficult to work economically and the present situation finds the European Coal and Steel Community no longer able to maintain an ailing industry in its midst.

Measures to make Belgian coal competitive within the Common Market — which has temporarily ceased to exist — are already well under way. The salient feature of the programme is the reduction of capacity to 23,400,000 tons by 1962 — a cut of 5,500,000 tons. By the end of 1959, ten pits having a combined capacity of 2,400,000 tons had closed down. Closures will be confined chiefly to the Berinage field and by 1962 nine of the fourteen pits will have ceased to produce and the remaining five will be amalgamated. These closures will render redundant some 27,000 miners, and the High Authority has set aside sufficient funds to provide for the re-absorption of those men who do not find alternative employment.

The funds will allow payment to be made as follows: total compensation for loss of earnings for the first four months, 80 per cent for the next four months, and 60 per cent for the following four month period. Payment will also be made to cover any displacement or removal costs and free vocational training for those requesting it.

Further measures taken by the High Authority to promote the improvement of the Belgian coal industry include subsidies to mines which require capital aid in order to reorganize and become competitive. However, the Authority's payment of adaption aid is conditional upon the closures and reorganization being carried out by a stipulated date. Thus it is not likely that the previous failure of the Belgian coalowners to reorganize their industry will repeat itself.

The overall effect of the scheme is that the Belgian coal market is cut off from the rest of the Community and becomes a preferential trading area. During this year the Belgian Government is required to license imports of 3,550,000 tons, of which 2,950,000 are to come from Community countries. Thus some 83 per cent of total imports are to be Community-supplied, compared with about 55 per cent since 1954. It is believed that the U.K. will be allocated some 180,000 tons, roughly a third of the 1954-1957 overage.

Belgian exports to other E.C.S.C. countries are limited to 1,950,000 tons, except for supplies sent to Italy. Thus an extensive system of import and export licensing is necessary, as are certificates of origin in the internal trade of the Community member nations.

EXCAVATION OF

ALTHOUGH much of the iron-rich, direct shipping, Mesabi ore is yet to be mined, producers are looking to the day when the supply will be dwindling. To solve the problem of supplying vast amounts of ore to the nation's steelmakers, the almost unlimited resources of low-grade ore are being tapped.

Taconite is the mother ore from which deposits of high-grade (50 to 60 per cent Fe) iron ores were formed by nature. About 95 per cent of the 100-mile long, four miles wide Mesabi Range is ore bearing taconite, one of the hardest rocks known to man. It actually tests about 600 Brinell and takes 55,000 lbs. of pressure to crush a one-inch block. Particles of iron ore, making up 15 to 30 per cent of the taconite rock, are so finely disseminated that the rock has to be ground to 80 per cent minus 325 mesh to liberate the dust-like particles.

Added to the problems of digging the taconite and removing the iron ore are the complications involved in making the tiny particles usable in the iron- and steel-making furnaces. Professor E. W. Davis (as former head of the University of Minnesota Mines Experiment Station, now retired) devoted more than 40 years towards the development of a useful blast furnace feed from otherwise useless taconite rock. The material is now made into pellets containing 62½ per cent iron, actually a tailor-made material for the furnaces.

So successful were pilot or experimental taconite plants and the first full scale, large production plants that followed, that the use of taconite is expected to increase by 200 to 300 per cent within the next quarter of a century.

Reserve Mining Company, owned jointly by the Armco and Republic Steel Companies, recently demonstrated its faith in the future of taconite by putting $190,000,000 into a new all-taconite operation. At the present production rate of 5,000,000 tons of concentrate per year the operation required an initial capital investment of over $38 per ton of annual production. The operation, however, was built so that the ultimate capacity could be increased to as much as 10,000,000 tons per year. This would require 30,000,000 tons of iron bearing taconite rock to be mined annually.

The actual mine is named the Peter Mitchell Taconite Mine in honour of the man who sunk, and had recorded, the first test pit on the Mesabi Range in 1871. It is located near Babbitt at the extreme north-eastern end of the Mesabi Range and covers an area nine miles long, 2,800 ft. wide and 175 ft. deep at the thickest point. A 1,500,000,000 ton taconite body running about 25 per cent recoverable iron in content is contained in the property.

Since part of the taconite formation lies under a slate rock strata, pit limits were laid out to eliminate the majority of rock stripping. These limits also provided for a highly efficient system of access roads.

Main roads, 50 ft. wide, run the length of the pit on both sides. Cross roads are cut at about 1,200 ft. intervals and these join with a main-line haul road travelling the length of the pit floor, currently 3½ miles long. This road, in turn, has branches to the various faces being worked.

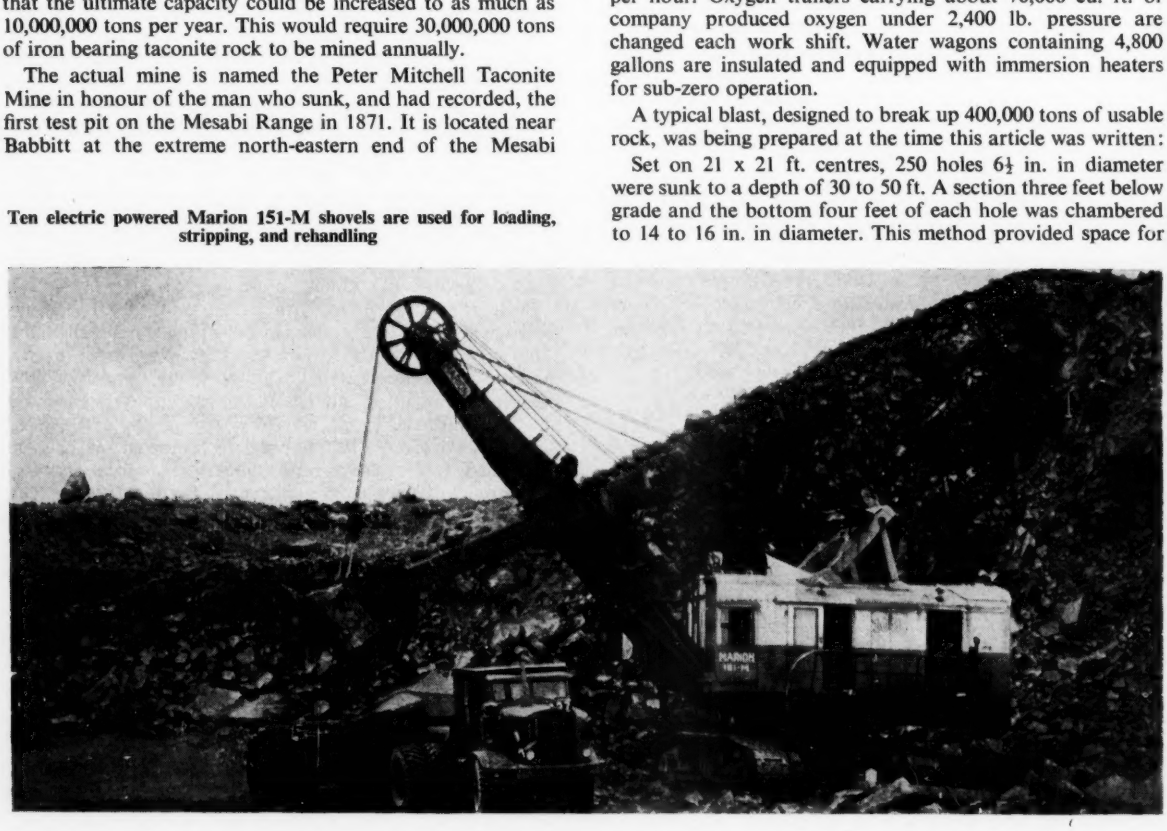
Blast areas are cleared so that drill rigs have a solid, level working bench. Blocks are opened every 1,200 ft. along the initial or development cut. Working benches are about 35 ft. high.

Four jet-piercing machines are used to burn 6½ in. holes in the tough taconite. The jets, using kerosene and oxygen, create a heat of 4,300 deg. F. to enable a penetration rate up to 35 ft. per hour. The average rate is slightly over 16 ft. per hour as compared to a rate of one foot per hour for regular rock drills. The jet-piercing machines work 20 shifts per week, five days per week. Wednesdays are reserved for blasting and plant wide maintenance. When the jet piercers are operating they consume about 1,000 cu. ft. of oxygen, 275 lbs. of kerosene and 1,000 gallons of quenching water per hour. Oxygen trailers carrying about 70,000 cu. ft. of company produced oxygen under 2,400 lb. pressure are changed each work shift. Water wagons containing 4,800 gallons are insulated and equipped with immersion heaters for sub-zero operation.

A typical blast, designed to break up 400,000 tons of usable rock, was being prepared at the time this article was written:

Set on 21 x 21 ft. centres, 250 holes 6½ in. in diameter were sunk to a depth of 30 to 50 ft. A section three feet below grade and the bottom four feet of each hole was chambered to 14 to 16 in. in diameter. This method provided space for

Ten electric powered Marion 151-M shovels are used for loading, stripping, and rehandling



MESABI TACONITE

extra explosives and helps prevent large blocks from loosening, an inherent feature of taconite rock. When piercing was complete all equipment was removed from the area before any explosives were brought to the site.

Virtually no explosives are stored at the mine. Deliveries are made, as needed, from Hibbing, Babbitt, Gilbert and Virginia in Minnesota and from Clarksdale in Wisconsin. Ammonium nitrate was purchased for the blast in 1,600 bag car-load quantities. It was brought from the rail siding to the blast site by trailer trucks hauling 800, 50 lb. bags per load.

First to go into a typical 6½ in. hole was a prime charge of 30 lbs. of 70 per cent dynamite. This was followed by succeeding layers of three 50 lb. bags of ammonium nitrate mixed with two gallons of diesel oil and 50 lbs. of 80 per cent prilled Pelletol. These layers were poured until 25 bags of ammonium nitrate and 400 lbs. of prills were in the hole. Then a top prime charge of 2 x 3 in. Procore booster No. 3-C was lowered. Almost 1,700 lbs. of explosives were used in each of the 250 holes.

Delay fuses of nine milliseconds were used on the open-face portions of the area while 17 millisecond delays were used for the enclosed portion.

The 400,000 ton blast required slightly more than one pound of explosives for each ton of taconite brought down. Over 99 per cent of the rock was small enough to be immediately usable, leaving less than one per cent to secondary work. Over 50 per cent of the rock was broken to minus 3½ in. Fragmentation as thorough as this has indicated an increased shovel dipper life of 300 per cent and extended the life of the dipper teeth from 12,000 tons to 31,000 tons, as compared to earlier blasting methods. It is also estimated that the life of the ten Marion loading shovels improved by 91 per cent and the primary crusher by 70 per cent.

Loading the hard, abrasive, heavy (one broken yd. weighs 4,400 lbs.) rock requires heavy-duty equipment. Special 45 ton side dump trailers had to be fully lined with high strength alloy steel as manganese or alloy bars couldn't take the wear.

Jet-piercing machines generate 4,300 deg. F. flames to burn 6½ in. holes at 35 ft. per hr. penetration rate

The ten Marion Type 151-M electric loading shovels, normally carrying a standard 7 yd. dipper, were ordered with special two piece, heavy duty dippers having a reduced capacity of 5 yds. It was felt that due to the abrasive nature and the weight (22,000 lbs. per 5 yd. dipperful) of taconite, the shovels would have an extended life with the small dipper. Experiments with larger dippers are now being conducted.

As the ore quality varies from 16 to 30 per cent at the many different faces in the pit, a balance of 25½ per cent is maintained by switching loading trucks and shovel crews from one location to another. An average of five of the ten Marion shovels are actually used to load ore at any one time with another two 151-Ms at face locations not being excavated. Regular daily production varies from 40,000 to 50,000 long tons of loaded taconite rock. Two additional 151-Ms carrying seven-yard dippers are engaged in stripping or loading stockpiled material into rail cars. A tenth shovel is usually scheduled for periodic overhaul and inspection in the company shops.

All loading operations are conducted on a 24-hour per day, five-day per week basis. Each Wednesday maintenance crews inspect each machine and make any needed repairs to keep all units in top working condition.

Almost 1,700 lb. of explosive is placed in each 30 ft. to 50 ft. deep blast hole

Tractor trucks powered by 300 h.p. engines pull the 45-ton trailers about ¼ of a mile to an electronic-controlled dumping station. One man controls traffic, spots the trucks and empties them by pushing a button that causes a huge hook to engage the trailer body and tip it towards a chute. Forty-five tons of taconite roars into the world's largest crusher.

This 60 in., 2,500 t.p.h. gyratory coarse crusher reduces the rock to minus 8½ in. The rock then drops to a bin feeding four 30 in. gyratory crushers. Actually only three of the 30 in. crushers are in use at any one time, the fourth unit being reserved for standby duty. Rock passing through the 30 in. crushers is minus 3½ in., the final shipping size.

The entire crushing system required a hole 200 ft. deep. From the lowest level, the world's strongest conveyor belt transports the broken rock to tandem silos with a combined capacity of almost 10,000 long tons.

The 1,000 ft. long conveyor belt is 60 in. wide and transports taconite at a rate of 3,000 t.p.h. The belt, reinforced with steel cable, is under a working tension of 120,000 lbs., making it the strongest in the world.

Company owned and operated rail cars pass under the silos on two- way tracks at a rate of one car every two minutes. Capacity of the standard gauge cars is 85 long tons. Up to 110 cars make up a train which carries the ore over a 47-mile long company owned railroad to the E. W. Davis Works at Silver Bay, Minnesota. Here a huge new plant concentrates, pelletizes and ships the ore.

USE OF PHOTOGRAMMETRIC METHODS IN OPEN PIT MINING

As a means of providing periodic maps of opencast mines as accurately and cheaply as possible with a minimum of interruption to the mining operation, the photogrammetric method appears to be finding increasing favour under suitable conditions. Not only is this method being employed for small scale mapping projects but it is also being used for producing large scale plans and maps.

By this method it is possible to produce periodic maps of the pit at the required scale and accuracies ; cross sections through the pit at regular intervals for volume computation ; photographic prints for geological interpretation ; operation plans and equipment distribution ; an accurate photographic record of mine conditions at a specific date ; and improved surveying efficiency.

Over a period such a method is claimed to yield considerable savings, especially in those mines with long lives. At the same time, photogrammetric equipment is costly and experts are required to use it. Whether the work would be done by the mine's own staff or let out to contract would depend on comparative costs. These vary with the size and life of the mine, etc.

Photogrammetric methods may be employed aerially or terrestrially or may be a combination of both, depending on the configuration of the mine and the physical characteristics of the ore ; mine development ; costs ; the possibility of establishing vantage points for terrestrial photographs ; type and cost of the instrument to be used to compile the map ; photographic coverage necessary, scale accuracy and ground control requirements ; and weather and flying conditions at the mine. In any case, ground surveys will be co-ordinated into and integrated with the photogrammetric programme.

Photogrammetric methods are claimed to make possible more precise mapping than would be provided by the existing ground survey methods employed in most mines. Mapping scales vary from 1 in. = 200 ft. to 1 in. = 500 ft. for administration and planning purposes, to 1 in. = 50 ft. to 1 in. = 100 ft. for engineering control and development purposes within the pit.

Cross sections can be derived photogrammetrically using the same photographic model as that used in drawing the plan map, volume data being obtained by planimeter from the directly plotted profiles or the readings of various heights along the profiles.

In Germany, both aerial and terrestrial photogrammetry have been used in the lignite-brown coal mines in half-a-dozen or more mining districts since 1920, though now aerial photography is used almost exclusively. These methods have also been used in Czechoslovakia, Hungary and Turkey.

In West Germany in 1954 experimental mapping of a brown coal mine by terrestrial photogrammetry showed, by checks at 20 points, an accuracy of 6½ in. for horizontal measurements and 1 in. for vertical measurements, but because of the difficulty of establishing good exposure stations the terrestrial method was not proceeded with.

In the Rhine opencast lignite mines near Roddergrube, West Germany, where the daily output is 85,000 tonnes and production involves the removal of 262,000 cu. yds. of overburden daily, photogrammetric methods combined with electronic computation have been used for periodic surveys. Known survey points are controlled and marked with 5 x 5 in. signals, being selected so as to be always re-usable. The height from which the photographs are taken is 3,000 ft. and plotting is done by high precision Zeiss Stereoplanigraph. The operators are members of the regular mine staff and the maps produced, on scales between 1 in. = 42 ft. to 1 in. = 167 ft. have been achieved with an accuracy of 4 in. for both horizontal and vertical measurements. Numerical profile data is obtained directly from the stereoplanigraph and registered on punched cards. Volume computations are done by Remington Rand computors from the punched cards.

Operations in the United States

In the United States, the Kennecott Copper Corporation is using photogrammetric methods for periodically surveying a 972-acre open pit mine at Bingham Canyon, Utah. This work is carried out by an aerial photogrammetric firm under the supervision of the mine's engineer. In addition to taking the photographs the contracting firm undertakes a ground survey to establish horizontal and vertical control points identifiable on the photographs and prepares the required map. A Kelsh plotter is used for stereophotogrammetric map making.

The advantages claimed by Kennecott for this method over the traditional ground survey methods are that the maps are up-to-date and take about four weeks to prepare instead of five to six months ; the cost savings are in proportion to the time saved ; field investigations are held to a minimum ; inaccessible, dangerous or otherwise difficult areas for ground survey can be quickly photographed and mapped ; weather and seasonal problems do not hold up planning work, once the photographs are taken ; the mine can get a definite cut-off date, so that contour changes, waste and ore removed can be accurately determined during a given period.

In addition to its use in open pit workings photogrammetry can be used for assessing the volume of stockpiles.

MINERAL RESOURCES OF THE LEEWARD AND BRITISH VIRGIN ISLANDS

REPORTS on the Geology of the Leeward and British Virgin Islands prepared by P. H. A. Martin-Kaye, A.R.C.Sc., B.Sc., M.I.M.M., F.G.S., Government Geologist, include details of the mineral and metal possibilities of these islands, which appear to be very limited.

In Antigua, the prospects of mining activity seem absent apart perhaps from some further minor production of barytes. Various clays and rocks have local uses but none is likely to produce any important industry. Barytes occurs, generally, as small veins or veinlets or small pieces of float and only at Belmont and in an association of occurrences in the Dockyard Shirley Heights vicinity is there any notable quantity. Only the slightest copper mineralization has been observed and nothing in the nature of a radioactive mineral has been recorded from the Lesser Antilles.

Small amounts of poor quality salt are taken from natural salt ponds and the possibility of turning Goat Island Flash into a major saline source still remains. The cost seems rather higher than warranted, but is considered reasonable should the experiment succeed.

There appear to be no mineral deposits of economic worth in St. Kitts. Again, salt is produced from sea water by solar evaporation. The occurrence of pellets of pitch-like material on the Conaree Beach (as in some other islands of the West Indies) has led to further examination but the material is not considered of immediately natural origin and no genuine oil or gas seep has been seen, nor is anticipated, in any of these islands. St. Kitts possesses small but useful reserves of limestone at Brimstone Hill and Godwin Gut.

On Nevis, there is an area of alunitized and kaolinized rocks locally showing very minor copper mineralization and from which traces of gold and assayable quantities of silver have been reported. Sample examination is not yet completed. The occurrence of alunitized areas in volcanic regions is common on Nevis.

Until laboratory data on many of the samples is completed it is not possible to assess the economic prospects of Nevis. Drillhole exploration would be necessary for an accurate appraisal. The Nevis material is natro-alunite, with soda predominating over potash, and it is thus not suitable as a fertiliser source. No important use can be foreseen for the local accumulations of heavy mineral beach sands occurring on Nevis.

One of the main interests of Redonda is the occurrence of aluminous phosphates of exceptionally high phosphorus content and at one time quarrying operations were carried out.

The Redonda phosphates appear to be of little use directly as a fertiliser and their value would be for reduction to elemental phosphorus. The commercial outlook is poor; the reserves are not known and it would be expensive to determine them. Reports also say that the material is becoming more difficult to win.

Sulphur encrustations in Montserrat are prominent round various vents in the soufrieres and also occur locally and variably impregnated in the rotted rocks where quiet seepage has been taking place. The yellowish colours of some of the alteration products and iron staining have, on occasion, given the impression that considerable quantities of sulphur are available, but this is not the case. The only likely prospect for utilizing the sulphur seems to be in a very small enterprise, employing a handful of men and using only the best material available and operating a small retort for refining. This has been tried before elsewhere, with apparently only indifferent success.

Red ochres occur locally on Montserrat in the soufrieres and a small deposit with an estimated 400 tons in sight is located at Carrs Bay. Analysis shows that it contains 22.34 per cent Fe_2O_3 with 6.24 per cent loss on ignition and it loses 5.37 per cent H_2O when dried at 110 deg. C. A sample examined in St. Kitts rendered 17½ per cent of fine grade red ochre. Such material could be used locally for the preparation of colour washes and paints, but imported ochres are cheap and it would probably be scarcely worth the trouble.

Various beaches on Montserrat are formed of black sands, essentially a magnetite-pyroxene assemblage, one such beach, Fox's Bay, being estimated to contain about 10,000 tons of magnetite in 400,000 cu. ft. of sand ranging up to 5 ft. in thickness. Other beaches carry similar accumulations but in smaller quantities.

Copper and Molybdenum

Mostly minor, copper indications are numerous in the British Virgin Islands and both copper and molybdenum ores have been exported from Virgin Gorda. The issue of *The Mining Journal* of June 26, 1852, v. 22, p. 311 mentioned renewed interest in this old established mine and proposals to re-open it. According to this report the average quality of ore was 20 per cent and had obtained upwards of £31 per ton in Swansea. The lode being 3 ft. wide at 45 fathoms " 200 tons (of ore) per month could easily be procured ". The mine, in fact, reopened under the management of John Taylor and Sons and was again mentioned by *The Mining Journal* of March 31, 1860 v. 30, p. 217, where it was said that water had been " forked " to 30 fathoms and that the upper levels looked promising. In 1882, the property was sold by the government reputedly to a Cornish company for recovery of taxes in arrears.

In 1915, the mine area was leased for three years to an Englishman, W. W. Hollings, who embarked on a small enterprise of hand-picking molybdenum from the dump. On expiry of the lease, it was taken up by an American on behalf of T. S. Catto, C.B.E., but the mine was not worked. It has been subsequently examined on several occasions and is at present under a prospecting lease. The vertical and lateral extent of the veins is not known, neither the grade of ore nor the quantity likely to be obtainable. Prospecting, in the form of re-opening and de-watering the old workings for inspection, combined with diamond drilling to explore the vein below the old workings, might be followed by drilling to check the downward extension of the limonitized zone to the east and the further group of surface-barren veins to the west, since both these might develop ore in depth. If the mine were re-opened it would now be operated as much, or more, for molybdenum as for copper content.

Small quantities of silver have been noted in some of the British Virgin Islands pegmatites and a few fragments of high quality graphite have been found in Tortola, while the pegmatites of Beef Island Bluff contain some crystals of pinkish felspar.

ROLE OF THE U.S. BUREAU OF MINES IN 1979—II

The need for a concerted materials policy for Britain and the Commonwealth enhances the interest of an address by Marling J. Ankeny, director, Bureau of Mines, U.S. Department of the Interior, which was presented at the annual meeting of the American Society for Engineering Education, Pittsburgh, Pennsylvania, on June 16, 1959. This is an abridged report of Mr. Ankeny's address, presented in two instalments.

THE changing needs of society and the complexity of our national growth demands current information on mineral resources, scientific technological developments, transportation, and evolving patterns in industry that create opportunities for commercial development of mineral industries. The Bureau is singularly well equipped to make investigations of this type. The staff who gather statistical data and other mineral-industry facts used to prepare publications such as the *Minerals Yearbook*, must be equally able to evaluate as to report the information that flows across their desks. They must necessarily have the broad view required to prepare a mineral-industry study. In addition, however, this staff has available the specialists in all types of mineral research and science and investigation. The Bureau's mineral-industry studies attack such problems as supply-demand adjustment, taking into account the influence of technological advances, shifting market patterns, new discoveries, and other changes.

Sub-marginal Resources

I shall turn now to the Bureau role in the years ahead in the " development of sub-marginal resources ". The early phases of research in the development of large sub-marginal mineral deposits often fall to a government agency, because government has the greatest long-time interest.

While private industry has a deep concern in the development of sub-marginal resources, its own investment in research that may not bring a financial return for many years must necessarily be limited. Hence, such work is frequently done in co-operation with government, or left to government alone.

Sub-marginal deposits that contain ores of strategic materials necessarily receive priority treatment by the Bureau, for in times of emergency, adequacy of supply can be a greater factor in their development than cost.

Examples of resources of this type are the oil-shale deposits which contain a tremendous potential reserve of petroleum; manganese deposits in several sections of the United States; aluminous clays and similar materials that may be substituted for bauxite; and perhaps low-grade iron-bearing materials that may in the future be usable as iron ore.

The long-range aspects of developing sub-marginal resources demand careful timing. Knowledge of the location, extent and quality of sub-marginal deposits must be available, but exploitation must frequently await the development of newer mining and processing techniques.

Advancing technology will bring enormous lower-grade resources closer to commercial usefulness. Large-scale desalting of ocean water for use would create an abundance of salt brines enriched in the numerous trace constituents of ocean water. Magnesium and aluminium are abundant in many rocks and soils and there is a limitless supply of magnesium in the ocean. There is a relative abundance of zirconium and titanium.

Large-scale production of principal constituents of ores often produces a surplus of by-product minerals. Vanadium from uranium ore is an example. There is need also for constant alertness to national and local changes that may give value to a previously worthless resource.

The second phase of sub-marginal resource development is research to find economic mining and processing methods. Because the resource is usually unlike conventional ores worked, pioneering studies are needed to seek out revolutionary new methods.

Substitution and Conservation

Another area of Bureau activity is in the development of " substitute and alternate materials " to improve the mineral position of the United States. It is difficult to anticipate the commodity areas in which there may first be need to search for substitutes in the United States. Substitution goes on endlessly as supply and prices of alternate materials fluctuate. When aluminium was substituted for copper in electric transmission lines, the substitution proved so successful that the metals are now used alternately according to price and application.

In the past decade or so there has been active search for substitutes for tin, manganese, tungsten, copper, and of lead and zinc during periods of short supply. The shortage of minerals during World War II and the decade thereafter contributed to the rapid expansion of plastic materials as substitutes for metals and minerals in many uses.

The use of abundant substitute materials and the ability to manufacture synthetic materials both will add substantially to the mineral-supply situation in the United States, aid its economy, and contribute to its security. Participation in programmes to find substitutes or to make synthetics will undoubtedly be a major role of the Bureau 20 years from now.

The Bureau defines conservation as the wise use of our natural resources to meet best the nation's economic needs and assure its security. Wise use, however, can be achieved only by knowledge of the intricate patterns of supply-demand and need. These patterns will become increasingly complex in an industrial age such as ours, and wise use will require sound judgment based upon accurate facts.

Actually, all Bureau activities influence conservation, usually directly. Any of our research seeking more complete or lower cost extraction of mineral deposits, or directed towards improved metallurgical efficiencies, saves not only the mineral involved, but also represents a saving in the mineral materials consumed in the mining and extraction processes.

Of all areas, the conservation of our energy resources may be the most important with which the Bureau of Mines must contend. I believe that our role in this field will grow in the years to come, simply because machines demanding energy are so widely replacing manpower. Energy requirements have grown significantly with rising population and a greater *per capita* energy consumption. Projected energy consumption rates by many forecasters show an acceleration in the 20-year period ahead. There undoubtedly will be a need for developing alternative energy sources and promoting better use of the sources now employed. The Bureau, as always, will have an active part in research.

Mining Developments in Chile

THE most interesting feature of recent mining developments in Chile is the increasing importance of ferrous minerals. There has been both an increase in the number of mines worked and in the production and export of ores, so that it is now clear that within a few years iron mining in Chile will be of importance second only to copper.

In January-August 1959 Chile occupied the third place, after Venezuela and Canada, as supplier of iron ore to the United States, according to figures released by Chilean mining circles. From January to August, 1959, the United States imported a total of 23,590,371 l. tons of iron ore. Chile supplied 2,695,941 l. tons during the same period. The principal Chilean exporter of iron ore is the Compañia Minera Santa Fé, which exported from January to August a total of 1,218,405 l. tons.

A few months ago this company acquired ownership of the iron ore mine El Laco, reputedly one of the largest in the world and comparable to the famous Venezuelan iron mines. El Laco is situated about 280 miles (320 kilometres) inland from Antofagasta, in the northern part of Chile. It lies in the middle of the Andes, distant only 11 miles from the Argentinean border, at an altitude of 15,000 feet. El Laco is actually composed of four distinct ore fields, called respectively Laco Norte, Laco Sur, Tuyajto Este and Tuyajto Oeste, all within a three-mile radius.

According to information supplied by the president of Santa Fé, several geological and topographical studies have determined that the deposit contains over 3,000,000,000 tonnes of iron ores. The quality of the ore is very high, with excellent chemical characteristics, and with a ferrous content of 66 to 69 per cent.

For the proper exploitation of this mineral, a new port would have to be built, with direct railroad connections inland to the mines, and with a loading capacity of 8,000 tonnes per hour. Further, a village would have to be constructed for the 10,000 miners that would work at the mines. The total investment required is believed to exceed $300,000,000. The president of Santa Fé announced that negotiations are in progress with several foreign companies who wish to associate themselves with this development.

Foreign Investors

As previously reported in *The Mining Journal*, Japanese investors have recently begun to take an active interest in Chilean mining. A Japanese-owned mining company, Compañia Minera de Atacama Limitada, has announced the beginning of its operations to develop an iron mine, Las Adrianitas, located some 25 kilometres away from the port of Copiapo. The company, owned by the Japanese consortium Mitsubishi, expects to make its first shipment of iron ore, destined to Japan, in June of 1960. Some $6,000,000 will be invested in this venture, according to information supplied by company officials. This amount includes the property costs, mechanization of the Calderilla port, building a 20-kilometre road, camp housing, and extraction works. Twelve million dollars will be spent in Japan, where two new ore ships are being built, with a capacity of 35,000 tons each. These boats will be used to carry the mineral directly to Japan.

The former owner of Las Adrianitas, Señor Raul Buenaventura, sold the mine to Mitsubishi for the amount of $1,500,000. It is expected to produce about 360,000 tonnes of iron ore per year, all of which will be exported to Japan.

Canadians have also entered the Chilean scene. The Paposo mine, near Taltal, has been sold by Sociedad Latorre Prenafeta to a Canadian consortium for the amount of 550,000,000 pesos (approximately £185,000). The new owners contemplate an investment of some $3,000,000 and propose to construct two plants on the property, which is rich in copper deposits. This is the first Canadian investment in mining in this country, and it is expected that the start of the development work will give a much-needed impulse to regional activities in Taltal.

The Copper Industry

Plans have also been announced to increase the national smelting capacity, particularly for the production of copper concentrates. It is anticipated that the 1959 output by the leading Chilean copper producers will reach about 493,000 tons. This will be a new record output figure, exceeding the previous all-time high of 475,900 tons in 1954.

The new copper smelter, which is to be built at Las Ventanas, near the port of Quintero, in Chile, is expected to cost more than $9,000,000, of which $6,000,000 will be spent in foreign currency, and the rest in Chilean Escudos. This information has been released by the Empresa Nacional de Fundiciones (ENAF), subsidiary of the Chilean Corporation of Fomento a la Produccion (CORFO), which is an official body entrusted with development of natural resources and new industries. ENAF has called for public tenders for the moving of approximately 1,000,000 cu. m. of earth, as preparatory work to permit the installation of the smelting plant and accessory buildings. The work must begin by January and end before September 1960, when construction of the plant proper will begin, together with establishment of generating plant, blister conversion unit, and other sections, so that the whole project is scheduled to be ready for operation some time in the middle of 1962.

The new plant will provide employment for about 300 workers, but its real importance lies in the fact that it will give the opportunity to small and medium-sized miners in the central area of Chile to export their copper under the form of blister bars, as do the large mining companies.

In the future, it is planned to establish some subsidiary industries in the vicinity of Las Ventanas. For instance, there is a project for building a phosphate-fertilizers plant with capital from CORFO.

Apart from the Las Ventanas project, a French mining company operating in Chile, Compagnie Du M'Zaita, has announced plans to build up its refinery at Chagres, with an investment of 800,000,000 pesos (about $800,000). The Chagres refinery will serve to smelt minerals produced by the company at Las Condes and El Soldado, in the central part of Chile, near Valparaiso.

The Bank of London and South America reports in its *Fortnightly Review* that annual output from the new Andes Copper Mining Co.'s new mine, El Salvador, will be 100,000 tons of blister copper, which will more than compensate for the loss of 40,000 tons of output from the Potrerillos mine where reserves are nearly exhausted. The deposit at El Salvador is estimated at 380,000,000 tonnes of ore, with average copper content of 1.6 per cent.

The Anaconda Co., the parent of Andes, has announced that Anaconda is to build a new copper smelting and refining plant at the port of Chanaral. This plant, work on which is expected to begin in the middle of this year, will refine electrolytically not only the blister copper produced at El Salvador but also that produced in the smaller mines in the region.

Technical Briefs

Treating Lead - Barite - Fluorspar Ore By Flotation

The concentration of fluorspar ores by flotation is well established, but the treatment of lead - barite - fluorspar ores has long been recognized as a difficult process, resulting generally in unacceptable concentrates with relatively poor recoveries. Intensive research on this problem continually is being conducted to develop favourable reagent combinations and conditions suitable for treating such ores.

A flowsheet study based on successful laboratory tests for the treatment of a lead-barite-fluorspar ore by flotation procedures to yield marketable concentrates has been published by Denver Equipment Co., United States. The ore to be treated contained approximately 2.0 per cent Pb as carbonates, 36 per cent barite and 37 per cent fluorspar in a siliceous gangue with a small amount of calcium carbonate. The study was based on the treatment of 100 tons a day and reads as follows:

The lead-barite-fluorspar ore requires grinding to 100 mesh for economic liberation of the minerals. Grinding is conducted in a Denver steel head ball mill operating in closed circuit with a Denver-Morton cyclone classifier. The overflow, minus 100 mesh, passes to the lead flotation section. The high density underflow from the cyclone is returned to the ball mill for regrinding.

The cyclone overflow passes to a conditioner with a reagent 512 added to the conditioner to activate and collect the lead minerals. The conditioned pulp is subjected to rougher flotation with a small amount of Flotbel frother. The rougher concentrate is cleaned twice. The flotation tailing passes to a thickener to densify the pulp and remove excess reagents prior to the barite section.

The thickened pulp from the lead flotation section is subjected to two-stage conditioning for the depression of the fluorspar and gangue constituents in the first conditioner using citric acid and barium chloride. The activation of the barite in the second conditioner is obtained by the use of reagent 107. The conditioned pulp is subjected to rougher flotation with two-stage cleaning of the rougher concentrate using a small amount of citric acid in the cleaner circuit. The flotation tailing is then pumped to a thickener for reagent removal and pulp densification prior to fluorspar conditioning and flotation.

The thickened tailing from the barite section is subjected to two-stage conditioning in order to effect depression of the gangue in the first conditioner using depressant 60. The second stage of conditioning is for the activation of the fluorspar with oleic acid emulsified with reagent 402. The conditioned pulp is floated to produce a rougher concentrate which is then cleaned twice. In some instances it is necessary to heat the pulp in the fluorspar section for more effective separation.

The thickening of the flotation concentrates offers no special problem. The thickeners are of sufficient capacity to adequately handle the tonnage and provide ample storage capacity during any interruption of the filtering and drying sections. Fluorspar and barite concentrates have a tendency of building up on the thickener surface, but this can be taken care of by retaining rings near the overflow lip, so that only clear water overflows from the thickener. Sprays are helpful in breaking the froth on the thickeners. The thickened concentrates at 50-60 per cent solids are removed by Denver Adjustable Stroke Diaphragm Pumps and fed by gravity to the filters. The lead and barite concentrates are dewatered by disc filters and the fluorspar by a drum type fluorspar filter.

The filtered lead concentrate drops into bins. The barite and fluorspar pass to rotary dryers provided with dust collecting systems. The dried products go to airtight surge bins for bagging or storage bins for loading into hopper cars. The assays and recoveries obtained in the testwork are shown in the table.

The approximate quantities of reagents and selection of reagents can be determined by batch testing but actual plant operation is needed to determine the actual reagent consumption and cost. The reagents used in the treatment of this ore were developed by Float - Ore Ltd., United Kingdom.

PRODUCT	ASSAY %			DISTRIBUTION %		
	Pb	$BaSO_4$	CaF_2	Pb	$BaSO_4$	CaF_2
Lead Concentrate	63.5	—	—	89.1	—	—
Barite Concentrate	—	93.3	1.2	—	89.0	0.80
CaF_2 Concentrate	—	2.4	96.7	—	2.3	75.5

IRRADIATION IN METALLURGICAL ANALYSIS

A powerful method of qualitative and quantitative metallurgical analysis is provided by the technique of irradiating a minute area of the surface of a metallic sample with a fine-focus beam of electrons, and analysing the resulting emission of x-rays excited in the sample.

This type of analysis differs from most others because of its non-destructiveness and its ability accurately to detect minute local differences in composition. It is, therefore, a useful research technique for examining the detailed structure of metals and alloys.

An important feature of the microanalyser manufactured by the Cambridge Instrument Co. Ltd. is the incorporation of a deflection system in the electron microscope so that the electron beam can scan the surface of the sample. The instrument is not, therefore, restricted to point by point microanalyses but can also produce x-ray images showing, in turn, the distribution of selected elements over the area scanned. The x-ray image is displayed on one of the cathode ray tubes. The other tube simultaneously displays a reflection electron image of the same area so that a direct visual comparison between the surface topography of the specimen and the distribution of a selected element can easily be made.

The scanning x-ray microanalyser has already poved itself an exceptionally useful research tool for examining inclusions, the segregation of the constituent elements of an alloy, the effects of electrodepositing one metal on another, etc.

EXTRACTIVE METALLURGY OF EUXENITE

The U.S. Bureau of Mines has developed several methods for extracting tantalum and columbium (niobium) and the rare-earth compounds from ores and concentrates. A co-operative agreement was made by the Bureau with Porter Bros. Corp., United States, to process 200 lb. of its euxenite concentrate by methods that had been developed at the Albany Metallurgy Research Centre.

The euxenite concentrate was processed to extract and purify the valuable metals by chlorination, solvent extraction, and hydrometallurgical techniques. Chlorination was used to convert the valuable constituents into chlorides and to partly separate them. Solvent extraction techniques were used to separate the tantalum from the columbium. The rare-earth and uranium compounds were purified by hydrometallurgical methods.

The overall results of processing the euxenite concentrate were satisfactory. During chlorination 95.9 per cent of the euxenite was converted to chlorides. The solvent-extraction separation produced high-purity columbium and tantalum oxides. Approximately 80 per cent of the tantalum and 86 per cent of the columbium were recovered as pure compounds after passing through the separation system once. The rare-earth compounds in the chlorination residue were treated by hydrometallurgical procedures, which recovered 84 per cent of the rare-earth elements in a product that contained 59 per cent yttrium oxide. A 99 per cent uranium oxide product was obtained by processing the eutectic product from the chlorination.

Euxenite now is the major U.S. domestic source of tantalum and columbium. The mineral is a complex, multiple oxide and, in addition to tantalum and columbium, contains substantial quantities of uranium, thorium, titanium, yttrium, and the rare-earth elements. The objectives of the work were to process the euxenite and recover the following products: high-purity columbium oxide, high-purity tantalum oxide, titanium tetrachloride, a rare-earth product enriched in yttrium, and uranium oxide.

The procedures used for extracting and purifying these compounds had been developed in earlier investigations.

This work is described in U.S. Bureau of Mines *Report of Investigations 5531.*

Machinery and Equipment

An Airborne Gravity Meter

Hitherto a failure when used on an aircraft because of the relatively large forces imposed by the motion of the plane, an airborne gravity meter has now been used successfully in tests carried out by Fairchild Aerial Surveys Ltd., over Imperial Valley, California, United States.

Accounting for the success of the recent tests have been refinements in techniques to correct for plane speed and other factors. Corrections of 1,000 to 1,200 mg had to be made to compensate for motion when the plane was flying at 200 m.p.h. Included in the scientists who participated in the tests were Dr. Lucien LaCoste, co-inventor of the La-Coste-Romberg gravity meter used in the trials and Dr. L. J. Nettleton, world famed geophysicist.

A company named Fairchild-LaCoste Gravity Surveys Co. is to be formed to undertake gravity meter surveys. Initially, this will include the mapping of the earth's surface and developing gravity data for guided missile flight. Later, with refinements incorporated, the airborne gravity meter may possibly be used on slow planes or helicopters to explore ore and mineral deposits.

The Merton Frontloader loading from a blasted quarry face. Limestone is being transported

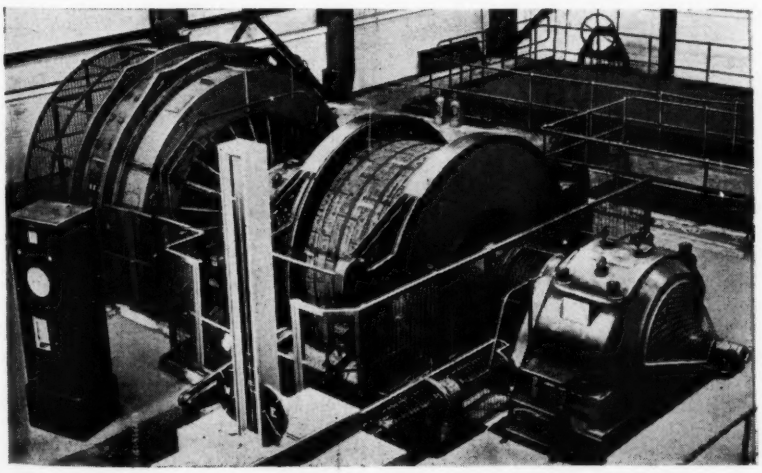
NEW FRICTION WINDERS

An entirely overhung armature is being used in new tower-mounted friction winders at Warsop Colliery, No. 3 Area, N.C.B. East Midlands Division, by A.E.I. Heavy Plant Division. By so doing, it has been possible to employ only two main bearings, and thus accommodate the deflection and distortion of the winder unavoidable in a steel-framed tower.

In No. 1 Shaft, the cage-winder motor is rated at 1,334/1,940 h.p., 78.4 r.p.m., and in No. 2 Shaft, where skip-winding is employed, the winder motor is rated at 1,638/2,120 h.p., 77.3 r.p.m. Each has Ward-Leonard control, with the laminated exciter closed-loop system.

A synchronous induction motor rated at 830/1,124 h.p., 750 r.p.m. drives the 840/1,537 kW M.G. set which supplies the No. 1 Shaft winder; and a similar motor, rated at 1,165/1,263 h.p., drives the 1,071/1,678 kW, 750 r.p.m. generator for the skip-winder motor. A changeover switchboard allows either winder motor to be supplied by either generator.

Men and materials only are wound in No. 1 Shaft, and coal exclusively in No. 2, which, from the arrival of the coal train at the tippling station underground to discharging at the top of the shaft, has an automatic winding system. Automatic operation depends on the flow of coal from the face. The arrival of the skip at the underground filling station operates a magnetic proximity switch which begins the sequence of operations by loading coal into the skip and then switching the flow of coal from the tipplers to the appropriate measuring pockets.



The skip winder at No. 2 Shaft, Warsop Colliery

Because the suspended loads in the two shafts are dissimilar, so are the mechanical arrangements of the winders. In No. 1 Shaft 1,338 feet deep, a two-rope winder is used with two-deck cages and a pay-load of four tons. The rope drum has a diameter of 11ft. and the cages are wound at a speed of 45 ft./sec. In No. 2 Shaft a four-rope winder is installed with two skips, each of eight tons capacity. The rope drum is eight feet six inches in diameter and therefore, although the direct-coupled motors on each equipment operate at almost the same speed, the rope speed in No. 2 Shaft is only 35 ft./sec. giving an output of 400 tons an hour from the 1,421 ft. depth.

The mechanical parts of the two winders, as well as the structural steelwork of the towers, were supplied by Guttehoffnungshutte—the structural work in consultation with Husband and Co., of Sheffield. Siemens Halske were also sub-contractors.

NEW FRONTLOADER

Merton Engineering Co. Ltd. announce that the Merton Frontloader 59, is available with torque converter power-shift transmission. The unit fitted is the Brockhouse hydraulic shift single stage torque converter which gives 2 forward and 1 reverse speeds of up to 5 and 10½ m.p.h. and 5½ m.p.h. respectively. The machine is powered by the latest type Fordson 4 cylinder 62 h.p. diesel unit. The front mounted cab has all round 360 deg. visibility and at all times the driver can see the digging edge of the bucket.

MINING MISCELLANY

Texas Gulf Sulphur Co., and The International Nickel Co. of Canada, Ltd., have announced encouraging results in the initial eight-months' operation of a pilot plant for obtaining pure sulphur from sulphur dioxide in the high quality roaster off-gas at Inco's large iron ore recovery operation in the Sudbury District of Ontario. Nearness to the Great Lakes offers Sudbury sulphur the advantage of low-cost transportation to eastern Canada and other large consuming areas. Feasibility of large tonnage commercial production will be determined by costs as projected from further pilot operations, and by the current market price of sulphur. The plant was completed a year ago, and, with associated facilities cost over $500,000. Initial operations consisted of test runs, but since April, 1959, operations have been round-the-clock and will be continued on this basis in an attempt to conclude successfully the development programme.

★

President William Tubman recently opened a new American-built harbour at Cape Palmas, 250 miles from Monrovia, Liberia. The harbour, which cost nearly $2,000,000, has a pier for two ships, and is between 20-24 ft. deep. Complete with warehouses, traffic lights and offices, this is Liberia's third harbour to be built during Mr. Tubman's term of office. A fourth harbour is to be built at Bassa at a cost of $45,000,000 by the Liberia-Swedish-American Minerals Co., which is operating iron ore mines in the Nimba Mountains of North Central Liberia. This harbour should be ready by 1963.

★

It is reported from Hungary that a graphite deposit at a depth of 525 ft. has been discovered by drilling engineers while sinking shafts for drinking water in the mining village of Szendro, northern Hungary. The extent of the deposit has not yet been established.

★

With the first silicosis research programme, which started in 1955, now having come to a satisfactory conclusion, the High Authority of the European Coal and Steel Community has decided to sanction a second programme. The Authority will grant, with permission of the Community's advisory committee, the sum of $2,800,000 to the scheme from E.C.S.C. funds. As well as silicosis, the project will cover research into the allied complaint of bronchitis, and problems connected with the effects of high temperatures, noise, poisonous gases, tiredness and fatigue symptoms and burns.

★

Figures recently issued from Budapest emphasize the sharp rise in Hungary's mineral requirements during the past few years. The Hungarian Chamber of Commerce report that in the period 1950-1958, minerals mining took up a greater share of the combined national industrial investment than any other branch of industry. Some 22.4 per cent of all investments made in that period were in the mining industry; a further 14.7 per cent in the metallurgical industry, and 10.3 per cent on machine building. As part of her attempt to keep the manufacturing industries well supplied with raw materials, Hungary has signed trade agreements for 1960 with Albania and Czechoslovakia, under which Hungary plans to import iron ore, chrome ore and brass from Hungary, and hard coal, lignite and coke from Czechoslovakia. Hungarian aluminium will be exported in part-exchange to Albania.

★

Reports from Lima indicate that production of the Toquepala copper mine in the south of Peru will begin this month. Operating company is the Southern Peru Copper Corporation, whose capital is owned by four North American mining concerns, American Smelting and Refining Co., holding 57.75 per cent of the shares, Cerro de Pasco Corporation and Phelps Dodge Corporation each with 16 per cent, and Newmont Mining Corporation holding 10.5 per cent. Total investment in the Toquepala mine, where 400,000,000 tons of copper are believed to be located, is U.S.$230,000,000, of which $115,000,000 was granted as credit by the Export-Import Bank of Washington. Since the start of preparatory work in April, 1956, some 129,000,000 tons of rubble and rock have been moved. Preparatory work on the site was carried out by the U.S. firms Utah Construction Co., and Morrison Knudsen.

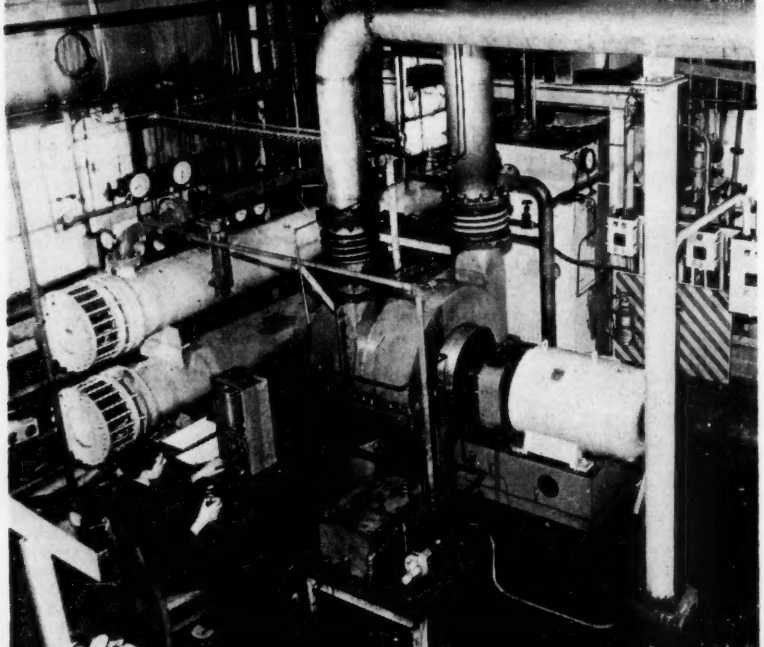
★

A new Minerals Information Bureau, has been set up in Southern Rhodesia. Initiated by the Minister, Mr. Cyril Hatty, in conjunction with the new Industries Branch of the Treasury, the Bureau comes under the Ministry of Mines, with Mr. Ralph Stanley in charge. The Bureau is now collecting and compiling technical information on the mineral industry of Southern Rhodesia, in order to provide a mineral information service relating to resources, production and marketing, which may be consulted by all interested people, including industrialists. The Minerals Information Bureau will act in close touch with the Industries Branch.

★

Six major North American copper producers have organized the Copper Products Development Association, Inc., to sponsor studies on new copper uses and products. The association does not plan to set up its own research facilities but will allocate study funds and assignments to individuals and research groups. Membership in the association will be open shortly to any copper producer. The six charter members are: American Metal Climax, Inc., American Smelting and Refining Co.; Anaconda Co.; International Nickel Co. of Canada; Kennecott Copper Corporation, and Phelps Dodge Corporation. Each of these companies has two members on the association's initial board of directors, and the board will elect association officers shortly. All inventions and patents, underwritten by the association will become the property of the association. Whenever a patent is granted, the association will make available non-exclusive licenses on uniform terms to interested parties.

Part of the pilot plant for obtaining pure sulphur from sulphur dioxide in the high quality roaster off-gas at Inco's large iron ore recovery operation in the Sudbury District of Ontario



According to a progress report for nationalized and State-owned industries for 1959, issued by the West German Government, the country's government is the biggest industrial interest in the land. The report contains statistics showing the share of government-held undertakings in total industrial production for 1958. These figures, followed by the 1957 share in brackets, show that the government holdings were concerned in the production of 36.7 (34.7) per cent of all iron ore mined in Federal Germany; 25.7 (same) per cent of all hard coal; 16.5 (16.7) per cent of the coke; 70.1 (72.1) per cent of refined aluminium; 5.8 (4.4) per cent of pig-iron; 5.1 (4.3) per cent of raw steel; 34.1 (39.7) per cent of the industrial lead; ;45.2 (43.5) per cent of industrial zinc; 16.3 (17.0) per cent of crude mineral oil; and 16.4 (14.6) per cent of the electrical current produced. Export sales of government - controlled industrial concerns, including hard coal interests, rose by some 4 per cent on the previous year, and total investment by a greater amount.

★

A West German consortium, consisting of the Friedrich Krupp, Hoesch, Mannesmann, Hüttenwerk Oberhausen and Gutehoffnungshütte concerns has announced from Düsseldorf that for the moment it is not to pursue its intention to take part in the exploitation of the large iron ore deposits on the Ungava site in northern Labrador. The German group was to have participated on a 50-50 basis in the exploitation of the deposits with Mr. Cyrus Eaton, the U.S. industrialist. The consortium, which has extended its option on participation until 1963, gives its reasons for postponing an active part in the project as the present heavy offer on the world ore market and certain technical and economic difficulties which stand in the way of the scheme. The question of the preparation process to be used for the Ungava ore, which is not of very high quality, has not yet been determined, and another difficulty is the transportation of the ore via a harbour in the Bay of Labrador, which is ice-free for only three months of the year.

★

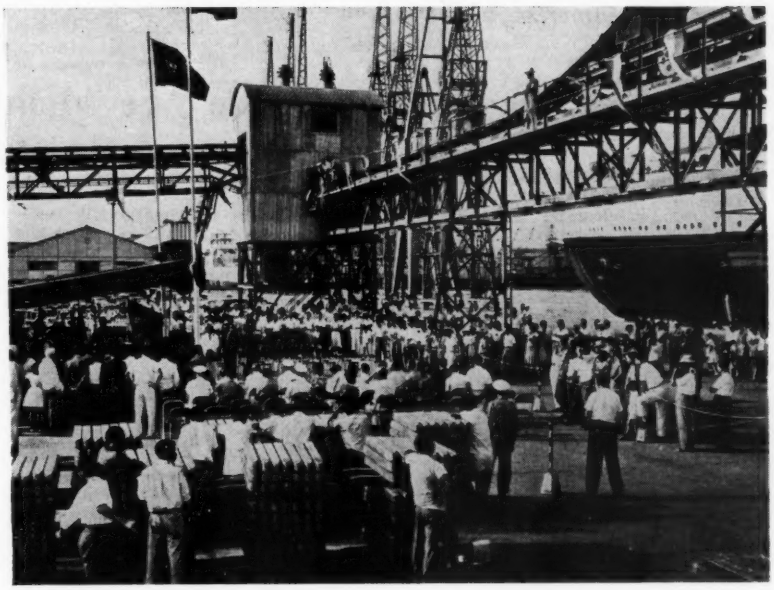
The national authorities in China claim that their country is now the biggest salt producer in the world. In 1959 an estimated total of nearly 50,000,000 tonnes of salt was produced in China, as against no more than 10,400,000 tonnes in 1958, and 4,900,000 tonnes in 1952. Should this estimate prove correct, China will have produced over double the output of salt produced in the U.S. during 1959.

★

A helicopter has been making a lift of about 15,000 lb. of building material, food and equipment to establish a camp-site for uranium prospectors 1,000 ft. up the almost sheer southern side of the Lower Buller Gorge, on the west coast of the South Island, New Zealand. The camp will form a base for further prospecting in the area where a mineral, thought to be pitchblende, was discovered recently, pointing the way to what may be the richest uranium deposits yet found in New Zealand.

★

Drilling at the Faraday Uranium Mines in the Bancroft area, South-eastern Ontario, has disclosed a rich new orebody on the 450 ft. level, about 500 ft. northwest of the shaft. The strike appears to be 300 ft. in length, and is estimated to contain 45,000 tons with an average grade of 0.35 per cent U_3O_8. The mine is currently handling a record 1,600 tons per day, and should continue at this rate for many more months. Faraday's present contract is expected to maintain operations at the current rate until about March, 1962, and it is anticipated that there is enough ore in sight above the 750-ft. horizon to fill the existing $45,000,000 contract.



A new mechanical ore loader which can load a ship with ore at the rate of 400 tons an hour, came into operation in the port of Lobito in Portuguese West Africa on December 5, 1959. The plant, built for the port authorities by Spencer (Melksham) Ltd. of Melksham, Wilts., increases the handling potential of the port from about 2,000,000 tonnes a year to about 3,500,000 tonnes. The loader handles ore from Rhodesia and the Belgian Congo which is brought through Angola along the 837-mile route of the Benguela Railway

★

Subject to negotiations being satisfactorily completed with the owner of the property, the Northern Aluminium Co., of the U.K. will build a £2,250,000 aluminium fabricating mill, about 13½ miles south of Auckland. The company hopes to begin construction early in 1960.

★

The Paipote copper smelter, which started operations in 1952 with a production of 9,100 tonnes of blister copper a year, will top the figure of 20,000 tonnes by the close of 1959, and it is expected that the plant will produce 24,000 tonnes in 1960. This Chilean undertaking has decided to grant $2,500,000 in loans to national mining companies in order to increase their capacity and improve their concentrating plants, and thus have adequate ore processing plants in all the zones served by the smelter.

★

Output of cobalt ore in Morocco is stated to be continuing its steady annual increase. For 1959, monthly production average was 1,000 tonnes, while for the whole of 1958 a total of only 9,250 tonnes was produced.

★

Demag, a West German engineering company, have concluded negotiations with the government of the United Arab Republic, and will participate in supplementary exploration work on three mineral deposits discovered in Egypt; the manganese ore deposit, near Bogma, on the Sinai Peninsula; an ilmenite deposit near Abughalaga, 25 kilometres from the Red Sea; and another ilmenite deposit in the Eastern Desert, near Hamash. Demag have been called in as advisers on post-survey work and will study transport possibilities as well as processing and marketing problems. They are also to advise on the production of titanium and titanium alloy from ilmenite ore. It is understood that these metals are intended both for domestic use and for export.

★

It is reported from Paris that French interests have formed a company in Brazil to mine a nickel deposit in the state of Minas Gerais. The company, Societe Morro do Nickel, has a capital of 240,000,000 cruzeiros. The French interests are Societe le Nickel, which is mining the rich nickel deposits in New Caledonia; the Banque de l'Indochine and the Franco-Brazilian banking establishment Credit Foncier du Bresil. Le Nickel will also undertake the engineering of the ferro-nickel plant which is to be built on the site. The nickel deposit will be purchased from the Brazilian firm Minneracao Sertaneja S.A., in exchange for 50 per cent of the capital.

★

The Dutch firm Wm. H. Müller of Rotterdam announce that it is to sell the Algarrobo ore concessions to the Chilean concern, Compania de Acero del Pacifico. Price of the concessions will amount to about U.S.$12,000,000, which is to be paid in 16 annual instalments.

Metals and Minerals

Shortage of Space Age Metals Feared

The possibility that in another 10 to 15 years there might be a critical shortage of metallic elements important in missile work and space exploration was mooted at a meeting of the American Institute of Chemical Engineers by Dr. Donald E. White, assistant chief of the Mineral Deposits branch of the U.S. Geological Survey. Of 69 such elements now in existence, it was stated, 37 are already regarded as being in critical supply or approaching a shortage point. High on the "critical" or "near critical" list are tungsten, rhenium, molybdenum, columbium and other alloying metals which can withstand temperatures of up to 3,500 deg. F. and consequently are important in space age projects.

Dr. White suggested that the soaring demand for both rare and common metals and minerals by the electronic, nuclear, missile, aircraft, plastics and other industries could be met in part by utilizing lower-grade ore and mineral deposits. He pointed out that this trend was already under way, since magnesium was being recovered from sea water and the mining industry was placing greater reliance on lower-grade copper ores. Increased recovery of elements as by-products of other metal and mineral refining was another answer to shortages, the cost of such recovery being lower than an original search for a natural resource.

The metals and minerals most likely to become scarce were those with extreme properties, such as tungsten's high melting point and aluminium's high workability, said Dr. White. Uranium, too, might some day be in short supply, but if and when that happened it could probably be mined from plain granite and this process would yield other metals as by-products.

In order to ensure a continuous supply of natural resources, Dr. White called for a more intensive investigation of new sources and active research to learn more about properties of metals and minerals. He lamented that in this respect the U.S. was lagging behind the Soviet Union.

This contention is borne out by a report which the Interior Department has made to Senator James E. Murray, who asked the department for a comparison between the Russian and U.S. programmes of mineral exploration and resource development. Although U.S. minerals production still exceeds that of the Soviet Union, the Russians are now training and employing more geologists, experiencing more scientific effort in the mineral field, translating more mining information from foreign technical publications, and are more self-sufficient in minerals than is the U.S.

The study showed that the Soviet Union was employing between 35,000 and 40,000 geologists — about twice as many as the total working in the U.S. for the government and industry and in the universities. Russia also is training geologists four times faster, having 12,000 geology students compared with 3,000 in the U.S.

The report noted that Soviet mineral policy was based on "abundant" native resources, whereas the U.S. in recent years has had to import more and more metals.

U.S. EXTENDS URANIUM CONTRACT

The U.S. Atomic Energy Commission has extended for more than 4½ years its contract to purchase uranium concentrate from the Bluewater, New Mexico, processing mill of Anaconda Co. The agreement calls for 4,000,000 lb. of uranium concentrate more than did the previous contract. It will run until December 31, 1966. The previous agreement would have expired on March 31, 1962.

Coming as it does within a few weeks of the A.E.C.'s announcement that its options on Canadian production would not be renewed, this news is hardly likely to have met with a favourable reception in the Dominion, where the consequential "stretch-out" of existing contracts with Canadian producers came as something of a bombshell to the uranium industry.

It has to be recognized, however, that the A.E.C. finds itself in no enviable position, being under fire simultaneously from the Canadian industry and from its own domestic producers, the latter having the more powerful guns. The dilemma in which it finds itself is underlined by the news that two uranium producers, Northwest Uranium and Silver Buckle Mining Co., both of Spokane, Washington, have lodged a $5,000,000 suit with the U.S. Court of Claims, alleging that the A.E.C. broke its word on domestic uranium procurement to their disadvantage. The suit represents what is believed to be the first instance of a domestic mineral producer attempting to collect damages because of policy changes on U.S. minerals procurement.

In its present heavily overbought position the A.E.C. obviously has little alternative but to modify its procurement policy, to the dissatisfaction of producers who had been misled by earlier and over-optimistic assessments of future needs. While the A.E.C. cannot fairly be blamed for its failure to predict more accurately the short-term requirements of an entirely new industry, with technological and economic problems which were quite unique, the fact remains that the present uranium muddle is a particularly striking example of the consequences of bulk purchasing by government agencies.

GOVERNMENT MARKETING FOR CUBAN NICKEL

It was announced shortly before Christmas that the revolutionary Cuban Government plans to make the National Institute of Agrarian Reform the exclusive purchaser of all nickel and other mineral output from the Oriente province from which the bulk of all Cuba's mineral production comes. This would seem to mean that all the Nicaro plant output as well as the nickel-cobalt concentrates from Freeport Nickel's Moa Bay project will come under the government's marketing control.

This news is hardly likely to make the Nicaro plant, at present up for sale by the U.S. Government, any more attractive than before, while in the case of Freeport Nickel, whose Louisiana refinery which is just coming into production was built specifically to handle Moa Bay production, must be wondering whether the Cuban Government intends in effect to do more than to levy a toll on shipments or whether the destination of Moa Bay output may eventually be determined by competitive bidding.

Almost invariably, the appeal to producers of any government marketing board is mainly due to the small operator, but in countries far more advanced economically than Cuba, government marketing of metals has not had a happy record, even when its purpose has been primarily to ensure equitable distribution among users. In the present case even this justification does not exist and we can only hope that this will not prove to be one more variation of the popular Latin American game of holding foreign mining up to ransom.

AMERICAN ALUMINIUM PROSPECTS

The equanimity with which the major aluminium producers faced the widening gap between production and productive capacity during the past recession is amply justified in this season's crop of year-end forecasts from the U.S.

The general concensus of opinion puts U.S. output of primary aluminium in 1959 at around 1,950,000 tons against the previous record of 1,679,247 tons in 1956. Estimates of shipments to consumers in 1960 vary from 10 to 20 per cent up on the 2,400,000 tons, which is expected to be the final total for 1959. Increases of this magnitude imply substantial gains in aluminium uses at the expense of other materials and indeed the Business and Defence Service Administration forecasts that the growth in aluminium usage in the U.S. in 1960 will be between 2 and 2½ times that of general industrial production.

Indicative of the buoyancy of the producers outlook is the forecast from a Kaiser Aluminium official that in the decade from 1958 the average amount of aluminium used in the American house would rise from 130 lb. to more than 1,000 lb.

All this must be especially good news for Alcan which, as usual, in times of American recession has been bearing the brunt of production cutbacks. At the moment Alcan still has something over 200,000 tons of installed smelter capacity in reserve, but it may well be that the need for completing stage two of the Kitimat project will come sooner than many had expected.

BOLIVIAN ANTIMONY SMELTER

A metallurgical company known as Vinto has installed a smelter for antimony metal at Oruro, in Bolivia. The smelter has been in operation since last March and so far has treated about 200,000 kilos of antimony ore. It is reported to have about 62 tons of metal available which assays around 99.3 per cent Sb. Apart from this tonnage, it is understood that there is about another 10 tons of metal in process. The intention is that the smelter will in the future process all the antimony ore produced in Bolivia. In 1958 Bolivia ranked third in the list of world producers, its exports amounting to 5,818 s.tons.

COPPER · TIN · LEAD · ZINC

(From Our London Metal Exchange Correspondent)

In spite of holiday influences, markets have remained active and there has been an appreciable increase in the prices of copper and lead. The zinc market has maintained its firm undertone but the tin market can best be described as drifting.

COPPER SHORTAGE WILL CONTINUE INTO FEBRUARY

As was to be expected, consumer demand fell off before Christmas but not to the usual extent and enquiries have been received from a number of overseas countries during the past two weeks. These have caused the price in London to move upwards with the backwardation, being maintained and stocks in official warehouses showing no overall change at 5,497 tons. With this backwardation the buying for tax purposes seems to have been smaller than in previous years and has probably not been sufficient to have had any influence.

The Belgian price has been raised in two stages from approximately 30.85 c. per lb. to 31.75 c. per lb. delivered New York or Antwerp.

The picture has been overshadowed by the continued unsettled situation in the U.S. to which has been added the political unrest in the Belgian Congo and murmers of labour trouble from Rhodesia which at the moment has only broken surface with a minor labour dispute at Mufulira involving a small number of rock breakers.

The situation in the U.S. is still very confused as the Kennecott settlement reported in *The Mining Journal* of December 18, was actually delayed until Christmas and it is only now that work is recommencing at some of the properties, while, it is understood that the Utah property, which is the most important, is still struck. Negotiations between the union and Anaconda have only reached a successful conclusion in one area and elsewhere negotiations appear to be deadlocked and the same can be said of the negotiations between the union and Phelps Dodge.

Whatever happens, the shortage of copper will be very marked during January and possibly February and although there is a possibility that the U.S. Government will release a tonnage from their stocks, it has been pointed out that the copper itself would have to be in the form of cathodes and that the expectations are that the tonnage would not be of sufficient magnitude to have any appreciable effect on the price.

Following the re-opening of Asarco's operations, the Customs Smelter quotation has now been re-established at 35 c. per lb. for delivery during February and merchant copper is changing hands at a little above this figure.

The results of the long U.S. strike are now being seen in published statistics which show that other producing countries have been able to step up production, for instance, the exports from the Belgian Congo for the first nine months of the year are estimated at over 200,000 tons as opposed to 180,000 tons in the same period the previous year and Chilean exports for the year seem likely to exceed the previous all-time high established in 1954 of 475,900 tons by some 20,000 tons.

TIN AWAITS U.S. STEEL SETTLEMENT

The tin market has been without any serious news and prices have tended to slip away but demand is still satisfactory and the full effects of the new quotas are still to be felt. With this metal it is the position of the U.S. steel industry which is most important. In spite of the almost unanimous opinion that a recommencement of the strike is unthinkable, the steel outlook does not seem too favourable, as at the time of writing the move whereby the unions are negotiating with individual companies does not appear to have produced any advancement towards agreement.

In the U.K., stocks in official warehouses have risen over the past two weeks by 609 tons to a total of 8,527 tons, but in spite of this the backwardation has been maintained although it is expected that the position will grow easier after the turn of the year. Following on the fixing of new export quotas, the Malayan Government has announced that all mines which have operated at any time between January, 1953, and December, 1957, would be allowed to resume operations and that applications for new mines would also be considered.

On Thursday the Eastern price was equivalent to £787⅞ per ton c.i.f. Europe.

BACKWARDATION IN LEAD

After many weeks of almost stable prices, the lead market has developed a backwardation which has raised the whole price level. This is attributable to the scarcity of nearby metal in the U.K. and, to a smaller extent, in Europe, but the general feeling is still not over optimistic and the majority of operators will be surprised if the present rise is continued much further. In the U.S. the situation is the reverse and there has been a further decrease in the price of lead to 12 c. per lb. and it is understood that in spite of the interruption in production, which took place during the strike at Asarco plants, there is more than enough metal available for present needs.

ZINC UNAFFECTED BY B.O.T. SALES

The zinc market is still enjoying very good consumer demand especially for high-grade metal and the announcement by the Board of Trade that they were selling another 3,000 tons for delivery during January, was accepted without any noticeable effect although, as we reported previously, some weakness had been caused by the rumour that the tonnage might be considerably in excess of the 6,000 tons the government were known to have for disposal. It appears likely that after the last 3,000 tons has been offered, which presumably will be some time after January, the Board of Trade may sell further tonnages provided the present market situation is maintained and the necessary permissions can be obtained from interested governments.

★

The fourth quota period for imports of lead and zinc into the U.S. is practically at an end and by the beginning of this week all had been filled with the exception of lead ores from "other countries" and zinc from Belgium and Mexico; in the latter two cases, only about 5 per cent of the permitted tonnage has been delivered.

★

The British Bureau of non-ferrous metal statistics for October, the September figures are given in brackets for comparison, show that consumption of copper totals 61,101 tons (57,367 tons) whilst stocks at the end of the month fell to 64,602 tons (77,803 tons). The lead off-take amounted to 32,926 tons (30,255 tons) and stocks were 56,697 tons (63,121 tons). Offtake of zinc fell slightly to 30,686 tons (31,270 tons) but stocks continued to fall to 35,994 tons (40,995 tons). Usage of tin totalled 1,915 tons (2,073 tons) and stocks were 10,383 tons (10,624 tons).

Closing prices are as follows:

	Dec. 24		Dec. 31	
	Buyers	*Sellers*	*Buyers*	*Sellers*
COPPER				
Cash	£251	£251¼	£255	£255½
Three months ..	£236	£236½	£239½	£240
Settlement ..	£251¼		£255½	
Week's turnover	9,625 tons		15,975 tons	
LEAD				
Current ½ month	£72⅜	£72½	£73⅜	£74
Three months ..	£72⅛	£72¼	£73⅛	£73¼
Week's turnover	7,400 tons		15,675 tons	
TIN				
Cash	£787	£788	£785	£785½
Three months ..	£783	£784	£782	£782½
Settlement ..	£788		£785½	
Week's turnover	655 tons		875 tons	
ZINC				
Current ½ month	£94½	£95	£94⅜	£94⅞
Three months ..	£90½	£90¾	£89⅜	£90
Week's turnover	5,775 tons		9,850 tons	

London Metal and Ore Prices appear on inside back cover.

Mining Finance

Two Years of O.T.Cs

Two years' experience of the 1957 O.T.C. tax provision have served to show two things: that without some such legislation, overseas mining companies—particularly tin producers—would have suffered even more than they did in the black days of 1958-9; and that notwithstanding this, the legislation as it stands is far too untidy to be accounted a complete success. Having been a prime mover behind the introduction of the O.T.C. system, the British Overseas Mining Association now sees it as its business to publicize these loose ends, and to press for their elimination.

The most important single provision omitted from the original legislation concerns O.T.C.s' profits from and loans to non-resident subsidiaries. As things stand, profits from such subsidiaries are treated as investment income, with the result that even if the profits are not distributed to the ultimate shareholders, they are liable for the full weight of taxation. Even more inequitable is the fact that a loan by an O.T.C. to an associated company is treated for tax purposes as if it were a distribution to shareholders.

As Mr. Conrad, this year's B.O.M.A. president, says in his annual statement, these were not unreasonable Revenue safeguards while the whole concept was in an experimental phase. It is also true that the prospect of a general election must have seriously deterred the government from making detailed revisions of the system in the 1959 Finance Bill.

The time has now come, however, to revise and consolidate O.T.C. legislation into a form that will enable the provisions to play their full part in British Overseas mining development. Quite apart from the anomaly referred to above, there is evidence of a narrow outlook in the rigid definition which the authorities have placed upon the term " recognized market " in Section 24 of the act. The point here is that a company selling a commodity of any kind in the U.K. may be disqualified from O.T.C. status unless its product is " of a kind bought and sold in a recognized market ". " Recognized Market " is not defined in the Act, but the Revenue acknowledges copper, tin, lead and zinc to fall within the definition. It does not necessarily admit any other metals. The situation therefore arises that whereas most Malayan Tin companies are able to acquire O.T.C. status without internal reorganization, Beralt, for example, had to hive off its wolfram sales organization into a separate, non-O.T.C. company, before it could qualify.

LONDON MARKET HIGHLIGHTS

Despite the small amount of business as a result of the Christmas holiday and the counter attractions of what seems to be a never ending industrial share boom, South African gold shares remained a remarkably firm market. Perhaps this was a good augury for the New Year ?

At all events the few buyers who took time off to enter the Kaffir market found stock none too readily available and prices very responsive to any inquiry. Welkom, for example, moved ahead smartly on a Cape demand to 22s. 6d.; the buying was linked with talk of development values of 1,000 dwts. and more being found in the December quarter. Similar influences were at work behind the rise to a best-ever 40s. in Loraine.

While this was going on, West Driefontein crossed the £10 mark ahead of Free State Geduld which had been a rather neglected market at around 188s. 9d. St. Helena perked up to 81s. after their recent setback and Western Deep jumped several shillings to 54s. 3d.; it was thought that the new issue of the latter's " B " shares might take place soon.

The finance group was also firm with a good investment demand being seen for issues such as Central Mining (95s.), " Johnnies " (78s. 3d.) and Union Corporation (83s. 6d.). But the Cape demand for " Freddies " which lifted the shares to 7s. was largely speculative.

De Beers became a strong feature in the diamond group. It was pointed out that next week should bring news of bumper sales figures for the December quarter and a high final dividend in March was confidently forecast. All this lifted the shares several shillings to 192s. 6d.

The fact that the price of copper remained fairly steady despite a series of settlements at the strike-bound U.S. mines had a tonic effect on the copper share market. Chartered climbed to a peak of 114s. and Messina were outstandingly firm at 137s. 6d. Shares resulting from the one-for-nine rights issue made by M.T.D. (Mangula) got off to a good start by reaching a premium of 3s. 6d. over the 9s. 6d. issue price on the first day. Bancroft jumped to 28s. and were seen by some—with a certain amount of justification—to be a good bet for capital appreciation in 1960. Rio Tinto's rise to 49s. 6d. emphasizes the group's big copper interests.

Tins remained a fairly active market but no very decided trend developed. Many potential buyers were still preferring to hold back until it is seen just how well the March quarter's high production quotas are absorbed by the metal market.

Although Lead-zinc shares moved narrowly, there could be opportunities in this section for capital gains in 1960. Consolidated Zinc for example still yield 5 per cent at 75s. 6d. and the group's vast industrial interests should continue to do well in 1960 quite apart from the benefits that are to come from the recent improvement in the outlook for lead and zinc. For the investor who needs maximum security of capital, it is worth pointing out that Consolidated Zinc Preference at 14s. yield as much as 6.4 per cent on the 4½ per cent dividend rate which was covered no less than 8.2 times by 1958 earnings.

Elsewhere, Consolidated Murchison moved up to 57s. 6d. in anticipation of good profits in 1960. Similarly, the brighter outlook for manganese was reflected by firmness in Central Provinces at the highest price for 1959 of 34s. 4½d.

PLATINUM PROSPECTS

The improvement in the financial state of Rustenburg Platinum, and, therefore, the publicly held holding companies, in the past financial year has been as sharp as the previous year's deterioration was severe. Indeed, with current assets of £2,967,199 outweighing liabilities by some £800,000, compared with an excess of liabilities of £27,000 last year, the epithet " healthy " is justified, unlikely as it would have appeared this time last year.

The debt of overexpansion, it seems, has now been paid, although the silent Waterval plant, completed in 1957 and still uncommissioned, remains as a monument to the boom that never was. In cash terms, this is to say that demand during the year was high enough to make possible a net profit of £1,888,524, compared with £1,385,359, as well as to allow the transfer back to profit and loss account of £1,084,823 on account of stock reduction. From this, it was possible to wipe out the balance-sheet over-expenditure of £1,000,000 odd, to declare a dividend of 26s. 3d. (at a cost of £1,140,037) and to once more have a balance on the profit and loss account.

For the future, therefore, Rustenburg appears well placed. Capital expenditure in the coming year will only be at the " normal " level of about £200,000, while demand looks like continuing to be at least as satisfactory as it was during 1958-9. The Waterval plant too, though something of a white elephant at the moment, is paid for and ready to go into production as soon as demand warrants, and will undoubtedly prove to be a most valuable asset at some time in the future.

There is, however, one factor that will prevent the Rustenburg revival from continuing at the rate seen in the past year. As a result of the 1957 expansion programme, Rustenburg was left with a sum of £1,360,000 to set against tax as at August 31 last. The next two years, however, will see a sharp reduction in this figure, so that the amount of taxation due from Rustenburg in 1959-60 will be materially above the £257,000 paid last year.

Nevertheless with yields at present between 7¼ and 8½ per cent, depending solely on marketability, the shares of the holding companies look to be a promising buy at the moment. In passing, it may be wondered whether the time has not come for Rustenburg to subdivide its shares and for the holding companies to pass them on to their shareholders. Union, Pots and Waterval are harmless — but the present rationalization of the mining industry only throws their uselessness into stronger contrast.

MONTROSE EXPLORATION AND ALLIED CHEMICALS

Allied Chemical Corporation of New York has announced that arrangements have been made for it to acquire 51 per cent of the shares of The Montrose Exploration Company. Montrose owns chrome ore deposits and mines in the Transvaal. The shares will be held by Allied's wholly-owned South African subsidiary.

The principal shareholders of Montrose will be represented on the reconstituted board of that company. Messrs. C. W. Roper and A. H. Johnstone of General Mining and Finance Corporation will remain on the board, the former as chairman and the latter as a director. Mr. W. J. A. Holmes of Pietersburg, Transvaal, will continue his connection with the Company as general manager and director and Dr. F. A. Zoellner will be appointed to the board to represent Alpha Free State Holdings Limited.

Allied Chemical, a leading producer of chromium chemicals in the United States, has entered into a long-term contract with Montrose for its requirements of chrome ore. Allied Chemical's Solvay Process Division manufactures chromium chemicals at Baltimore, Maryland.

An extraordinary general meeting of the Shareholders of Montrose will be held early in the New Year.

"Maiden" from Preston E. Dome.—Preston East Dome Mines has declared a dividend of $1 per share. Although this is the company's 59th dividend, it is the first to be declared since 1957. The preceding 58 payments were made from the earnings of the company's gold mine in the Porcupine district, whereas the present distribution represents the passing-on to shareholders of income from Preston's holding in Algom Uranium Mines, which recently paid a maiden dividend of $2.50. The Rio Tinto Mining Company of Canada owns 61.2 per cent of Preston's equity.

Rio's Cam and Motor Offer.—The offer of 11s. per share for Cam and Motor's 2s. 6d. shares made by the Standard Bank of South Africa on behalf of Rio Tinto (Southern Rhodesia) has been accepted in respect of rather less than 90 per cent of the total issued capital. Rio are nevertheless satisfied with the response and the offer has been declared unconditional, and will remain open for the time being.

Bikita Minerals to Stay Open.—Selection Trust has announced that Bikita Minerals, an associated company, will not now place its mine on a care and maintenance basis as had previously been announced. This was referred to more fully in Metals and Minerals last week.

De Beers Industrial.—Estimated net earnings of De Beers Industrial for 1959 are £1,162,900 after taxation and preference dividends. Last year's profit was £1,131,099. An unchanged dividend of 1s. has been declared, making 2s. for the year.

Jos Preliminaries.—Provisional profit of Jos Holdings in the year to July 31 last was £41,009, compared with £47,417 in 1957-8. A dividend of 12½ per cent has been declared. Last year a dividend of 20 per cent was declared, but there has since been a 100 per cent scrip issue.

Tweefontein United Profits Lower.—The profit of Tweefontein United Collieries for the current year is estimated at £133,400, compared with £153,123, after providing for taxation of £45,750 (£76,500). Dividends, including a final of 9d. per share absorb £97,594 against £86,750.

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BRITISH OVERSEAS MINING ASSOCIATION

NEED FOR EXPANSION OF O.T.C. LEGISLATION

The fourteenth ordinary general meeting of British Overseas Mining Association was held on December 21 at 49 Moorgate, London, E.C.

Mr. A. V. Conrad, President, said:—To an Association like ours, comprising members whose profits are for the most part earned overseas, the introduction of legislation in 1957 establishing a new tax status for a class of companies known as Overseas Trade Corporations was a matter of great importance.

An O.T.C. can enjoy a substantial measure of exemption from United Kingdom taxation and it was only to be expected that the legislation, which broke completely new ground, should have contained various safeguards for the Revenue. Unfortunately, these have to some extent detracted from the value of the new provisions. The Association hoped, however, that, as the Revenue acquired further experience of the operation of the O.T.C. legislation, a broadening of its scope and a relaxation of some of the restrictions cautiously imposed in 1957 would be found acceptable by the Revenue.

When the 1958 Finance Bill was introduced, the O.T.C. legislation had been operating for little more than six months and the Government was unwilling to introduce amendments until further practical experience of the legislation had been gained. In 1959, with the prospect of a General Election in the near future, it was hardly to be expected that the Government would wish to embark on detailed revision of the O.T.C. law.

By the time the new Government introduces its first Budget next year the Revenue and the taxpayer will have had more than two years' experience of the operation of O.T.C. legislation, and the Association hopes that the Government may be prepared to consider various proposals which, it seems to us, would greatly increase the value of the O.T.C. provisions to the British overseas mining industry.

Tax Treatment of Non-Resident Subsidiaries

The amendment to which the Association attaches the greatest urgency, and on which it has addressed memoranda to the Chancellor, is one which would enable O.T.C.s with non-resident subsidiary companies to treat dividends from those companies as exempt trading income. This would make it possible for such earnings, in so far as they are not distributed to the ultimate shareholders, to be transferred to the best economic advantage from one member of a group of companies to another. Proposals to this effect received sympathetic consideration from Government spokesmen in the debates on the Finance Bills of 1958 and 1959, but they were rejected on both occasions on the grounds that their adoption would open a door to tax avoidance. The Association believes that it would be quite practicable to devise safeguards against any such risk. This extension of the O.T.C. system, which would be entirely in line with the majority view of the Royal Commission, would be of considerable benefit to the overseas mining industry and the Association will continue to press for it.

Other features of the O.T.C. legislation which could usefully be modified include the provisions of the 1957 Act under which loans by O.T.C.s to associated companies are treated for tax purposes in the same way as distributions to shareholders and the very rigid definition applied by the Inland Revenue to the term "recognized market" in Section 24 of that Act. A further defect in the present legislation is that it does not overcome the legitimate complaint that United Kingdom taxes often frustrate pioneer and similar tax reliefs introduced as incentives in a number of countries. These matters are receiving the careful attention of the Association's Taxation Committee.

B.O.M.A. Scholarships

The work of the B.O.M.A. Educational Trust, which was generously endowed by contributions from the great majority of companies engaged in the overseas mining industry, has been energetically pursued. At present twelve young men are taking courses at Universities and Schools of Mines with the assistance of B.O.M.A. scholarships, some in their first and some in their second year. It is expected that further awards to be made in 1960 will bring the total number up to over twenty during the academic year 1960/61.

All candidates for these scholarships must, of course, have attained the academic standards prescribed for admission to the Schools of Mines and Universities and the Scholarship Committee, in selecting the successful candidates, has attached great importance to personality, character, powers of leadership and general aptitude for the overseas mining industry. There is every reason to expect that B.O.M.A. scholars, when they ultimately take up positions abroad, will make a valuable contribution to the industry.

General

I have been very conscious throughout my year of office as President of the valuable work done by the various committees to which the detailed work of the Association is entrusted. The Taxation Committee, in particular, has maintained a close watch on all tax developments likely to affect the interests of the overseas mining industry and has continued to bring the industry's views on these matters to the attention of the authorities. The Scholarship Committee also has devoted a great deal of time and thought to the selection of candidates for the scholarships awarded by the B.O.M.A. Educational Trust. I am glad to have this opportunity of expressing the Association's thanks to all members of these committees for their valuable work and to our Secretary, Mr. R. A. Alldred, for the painstaking and efficient way in which he has, under the guidance of the Executive Committee, administered the affairs of the Association.

THE NEW PIONEER CENTRAL RAND GOLD MINING COMPANY LIMITED

(Incorporated in the Union of South Africa)

CHAIRMAN'S REVIEW

The following is a statement attached to the Report and Accounts for the year ended June 30, 1959, issued by the Chairman, **Mr. Jack Scott.**

This review of the activities of your Company is submitted in conjunction with the Directors' Report for the year ended June 30, 1959, and the Accounts for the same period.

The Company has had a year of satisfactory progress, particularly in relation to its extensive property interests in the Stilfontein area. The position has been reached that, with the exception of the relatively small number of stands referred to in the Report, the Company has now disposed of the residential stands which it has been offering for sale in the original Stilfontein Township and Extension 3. Within this area, it has retained the ownership of all business sites, with the exception of the hotel, and as reported to you from year to year, a substantial building programme has already been carried out here and elsewhere including a large block of shops and offices in the Civic Centre, four garages and surburban blocks of shops in Extension 1 and 3. An active building programme is contemplated during the current year, including the commencement of a further substantial block of shops and offices in the Civic Centre. The book value of Land and Buildings at Balance Sheet date was £508,998. This figure included the cost of existing buildings and the ground on which they are erected, as well as the cost of ground in the proclaimed townships reserved for future business development.

To the west, the Company is proceeding with the development of Extension 4, as yet unproclaimed, where Zone 1 has been completely reticulated and the servicing of Zone 2 is nearing completion. Up to the end of October, 643 residential stands had been sold in these zones, leaving 328 residential stands and 34 business stands unsold. Beyond these zones and approaching the Klerksdorp Municipal boundary, there remains an area of approximately 176 morgen of Extension 4 awaiting development and it is in this area that a site for a drive-in cinema has been demarcated. In addition the Company has, since the close of the year, obtained an option to purchase 32 morgen of the farm Zandpan 423, south of the railway line, for a possible further extension of the township. The book value of developed and undeveloped vacant ground, the bulk of which is reserved for township purposes, was £475,773 at Balance Sheet date. This figure included a provision of £155,526 for township expenditure still to be incurred.

The net profit on sales of property during the year under review increased to £61,429, as compared with £9,170 in the previous year and the income from Net Rents and Freehold Revenue increased by £16,632 to £65,568.

There were no changes in the Company's holdings of quoted shares during the year, the book value remaining at £898,428. The year end market value, had, however, increased by over half a million pounds to £3,681,239. As reported to you previously this section of our investments is represented as to more than 90 per cent. by holdings in the Stilfontein, Hartebeestfontein and Buffelsfontein mining companies and other companies with interests in the Klerksdorp area. The dividend revenue was £292,957.

The total revenue of the Company for the year under review was £427,285, an increase of £75,553 over the previous year, whilst expenditure, including interest paid and depreciation, decreased by £6,971 to £51,676. £60,000 was set aside as a provision for losses and contingencies, leaving an excess of income over expenditure for the year of £315,609. £30,000 was provided for future taxation and £275,000 for Dividend No. 3, which at 2s. 9d. per share shows an increase of 10 per cent. over the previous year. Undistributed Profits carried forward increased from £158,778 to £169,387.

In regard to the minor investments of the Company, you will note from the Report and Accounts that the investment in unquoted shares increased from £169,593 to £244,421 and advances decreased from £142,040 to £48,809. The main factor in this change-over is the conversion of £86,200 of the Company's advances to S.A. Silica Bricks Limited into preference shares in that Company. The S.A. Silica Company has passed through a difficult year owing to the persistence of highly competitive conditions in the brick industry and the outlook for the future is unpromising. In view of these circumstances, the provision for possible losses previously mentioned has been created.

The total of unquoted shares at Balance Sheet date was inflated by the inclusion of £47,000 Stilfontein Health Committee Loan Stock, which had been accepted by the Company in part payment of the amounts due to it on transfer of township services. This Loan Stock has since been disposed of at par.

There will be a further reduction in the Unquoted Shares total within the next few weeks, when the Company receives a liquidation dividend of approximately £37,000 from the Glenara Estate and Mining Company Limited. This payment arises from the recent sale of the Glenara Estate and somewhat exceeds the written down book value of the Company's holding. Further small liquidation dividends will probably be forthcoming.

The Company's most important unquoted share investment is its holding of 128,286 £1 shares in Kenilworth Estates Limited. This ranching company, which owns approximately 200,000 acres some 60 miles north of Bulawayo, continues to make satisfactory progress and has recently paid a maiden 5 per cent. dividend.

This concludes my review of the Company's affairs.

At the Annual General Meeting of members of the Company held in Johannesburg on December 15, 1959, the Chairman said that he had no further information to add except to say that the Company has since declared its first interim dividend of 1/3d. per share payable to shareholders registered on January 31, 1960.

WITBANK COLLIERY, LIMITED

(Incorporated in the Union of South Africa)

Extracted from the ANNUAL REPORT for the year ended 31st August, 1959

AUTHORIZED AND ISSUED CAPITAL

£1,540,000 in Shares of £1 each, fully paid

Working Profit	**£403,679**	
Add Sundry Revenue *less* Expenses	**269**	
	403,948	
Taxation	**108,840**	
Profit after Taxation	**295,108**	
Balance of Income and Expenditure Account at 31st August, 1958	**285,767**	
		£580,875
Dividends declared :—Nos. **105** of **4s. 3d.** and **106** of **1s. 1d.** per share	**165,229**	
Transfer to Capital Reserve—net expenditure on mining assets and trade Investments	**102,189**	
		267,418
Balance of Income and Expenditure Account at 31st August, 1959		**£313,457**

There was an overall improvement of approximately **100,000** tons in the quantity of coal despatched from the Colliery. Of the deliveries totalling **1,710,733** tons, **1,463,811** tons were railed from the Wolvekrans Section, reflecting an increase of **137,161** tons compared with the previous year, and **246,922** tons were despatched from the Southern Section showing a decrease of **36,785** tons on last year's figure.

In relation to the capacity of the Colliery there has been a shortage of orders since January, 1959, which has had the effect, of curtailing production. The working profit for the year of **£403,679** nevertheless improved by **£61,082**, due chiefly to the higher output and to the increase of **1s. 3d.** per ton in the price of Transvaal and Orange Free State coal granted by the Price Controller with effect from 31st October, 1958.

It is estimated that capital expenditure during the year ending 31st August, 1960, will amount to approximately **£50,500** of which **£38,400** will be spent on further items of mechanical equipment for underground work.

The full Report and Accounts may be obtained from the London Secretaries, A. MOIR & CO. LIMITED, 4, London Wall Buildings, London, E.C.2.

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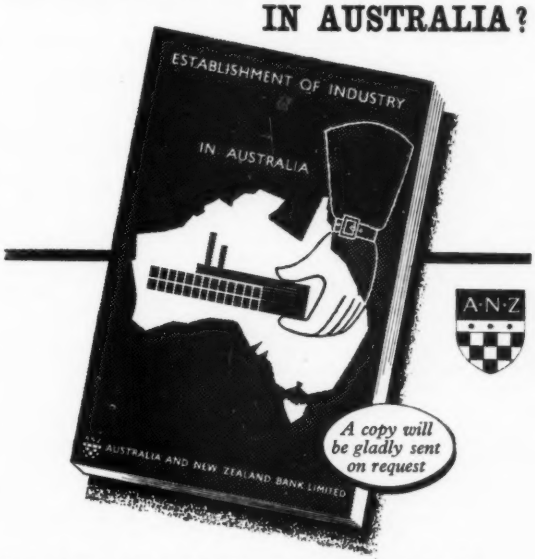
ESTABLISHING AN INDUSTRY IN AUSTRALIA?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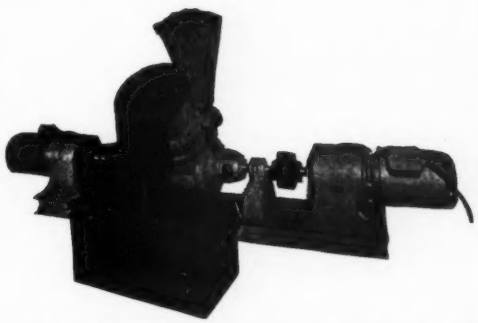

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CHAIRMAN'S REVIEW

The following is a statement attached to the Report and Accounts for the year ended June 30, 1959, issued by the Chairman, **Mr. Jack Scott.**

The Directors' Report and the Accounts for the year ended June 30, 1959, give you full information on the state of the Company's affairs at that date and on the continued progress of the mine during its second year of full production.

The working profit from the production of gold and uranium amounted to £4,974,533, an improvement of more than £1,000,000 over the previous year. After provision for interest and sundries the net profit carried to appropriation account was £4,628,675, as against which £2,006,198 was appropriated for capital expenditure, £1,021,364 for the redemption of loans and £1,650,000 for Dividends No. 3 and 4, representing in total 3/- per share.

In regard to the loan obligations reflected in the Accounts, the amount due to the Anglo American Corporation has since been reduced by £250,000, while the amount of £500,000 owing to the National Finance Corporation will be paid on due date, i.e. November 28, 1959. The uranium and acid loans are being reduced by regular quarterly payments.

As compared with the previous year, the average monthly milling rate increased from 111,000 tons to 126,600 tons, while the recovery grade increased from 6.586 dwt. per ton to 6.967 dwt. per ton.

During the first four months of the the current year, the milling rate has averaged 144,250 tons per month, with a recovery grade of 7.613 dwt. of gold per ton and 0.472 lbs. of uranium per ton, yielding a total working profit of £1,994,939 derived as to £1,147,939 from gold and £847,000 from uranium and acid.

In regard to development the report of the Consulting Engineers for the year under review shows that of the 24,970 feet sampled, the average values were 647 inch-dwt. for gold and 46.78 inch-lb. for uranium. During the first four months of the current year, development totalled 41,467 feet. Of this 6,658 feet were on reef and of the 6,630 feet sampled, 91.1 per cent proved payable at an average value of 623 inch-dwt. for gold and 48.16 inch-lbs. for uranium.

The ore reserves were built up to 3,034,000 tons at 9.84 dwt. per ton for gold and 0.685 lbs. per ton for uranium, an increase of 817,000 tons and a slight improvement in values as compared with the last published figures.

During the year modifications to the Pioneer Shaft, to provide additional rock hoisting capacity, were completed and the building of European and Native housing and the provision of underground equipment, pumping and ventilation facilities kept pace with the requirements of the mine.

Satisfactory progress has also been maintained on the excavations and construction work at the site of the sub-vertical shaft referred to in my statement last year. Sinking with temporary hoists is proceeding and the shaft had reached a depth of 275 feet below 13 Level, at the end of October.

The total expenditure on these capital works during the year was £1,575,167, which is substantially below the estimate of £1,800,000 given to you in my last review. There was also expenditure to the extent of £466,800 on the uranium and acid plants, including the completion of the extension of the acid plant to a capacity of 250 tons per day. Of this amount £368,411 was provided out of profits and the balance as a final draw on the relative loans.

Since the end of the year work has commenced on the extension of the gold reduction plant to a nominal capacity of 200,000 tons per month. It is planned to complete this extension by December, 1960. A start has also been made on the construction of the main offices.

There has been an unprecedented influx of native labour into the industry during the course of the year and the underground native labour strength has been maintained at 100 per cent. of its complement since last April. This has severely strained the accommodation facilities at the main compound. As a result it has become necessary to proceed immediately with the compound buildings at the site of the Eastern Twin Shafts, which are planned to exploit the eastern portion of the lease area. Although the sinking of these shafts is not due to commence until 1962, it will be necessary to provide services such as roads, railways, electric power, water and sewerage, earlier than planned.

Work on the construction of the compound and the provision of services is proceeding satisfactorily. A start has also been made on the pre-sealing of possible water fissures at the twin shafts by injecting cement through diamond drill boreholes at the shaft site.

It is estimated that during the current financial year, expenditure on these items, and on the sinking of the sub-vertical shaft, will amount to approximately £2,800,000.

As indicated in the Directors' Report, the Company has acquired the mineral rights of a portion of the farm Mapaiskraal, adjacent to the western boundaries of Hartebeestfontein and Buffelsfontein Lease Areas. The mineral rights of the whole farm which is 677 morgen in extent have been divided between the Hartebeestfontein and Buffelsfontein Companies by extending westwards the boundary between the two lease areas, which so far as is known at present, approximately follows the Kromdraai Fault. Buffelsfontein has purchased approximately 381 morgen of the southern portion of the farm Mapaiskraal. The deed of sale, however, provides that when the Kromdraai Fault has been located exactly by underground exploration, a mutual adjustment of the boundary within the newly acquired area will be made, if necessary. Any such adjustment will not affect the cost of these mineral rights to the Company, which will amount to approximately £135,000 and will be included in capital expenditure for the current year. In due course application will be made for the inclusion of the area in the Company's mining lease.

As regards uranium, the Company has had no difficulty in producing its allocated quota of 767,000 lbs. for the twelve months. The costs of production on a by-product basis, that is to say excluding any contribution to Mining and Milling Costs, and any provision for amortization, are of the order of 18s. per lb., one of the lowest figures recorded by the industry in South Africa, and to this extent the Company is well situated in relation to the important problem of continued sales after the end of the contract period.

This concludes my review of the operations at the mine over the past sixteen months. I wish to place on record the Board's appreciation of the loyal and efficient services rendered by the Manager, Mr. F. Nott, and his staff at the mine, as well as by the staffs of the Johannesburg and London offices of the Company.

At the Annual General Meeting of members of the Company held in Johannesburg on December 15, 1959, the Chairman said that he had no further information to add to that given in this review.

Christmastime.—Once again *The Mining Journal* received a delightful variety of calendars, Christmas cards and diaries from friends and well-wishers. We would like to acknowledge the good wishes for the New Year received from the following: Anderson, Boyes and Co. Ltd.; Atlas Copco; British Insulated Callender's Cables Ltd.; The Caterpillar Tractor Co. Ltd.; Crofts (Engineers) Ltd.; Dollery and Palmer Ltd.; F. Dupré Ltd.; The General Electric Co. Ltd.; Holman Brothers Ltd.; Mavor and Coulson Ltd.; Minister of Mines of Southern Rhodesia; The Mond Nickel Co. Ltd.; Richard Sutcliffe Ltd.; Stewarts and Lloyds Ltd.; Transvaal and Orange Free State Chamber of Mines; Turner Brothers Asbestos Co. Ltd.; The United Steel Companies Ltd.; Hugh Wood and Co. Ltd. We would like to take this opportunity of again wishing all our friends at home and abroad a Happy and Prosperous New Year.

The Proprietors of British Patent No. 698,978 for "Method and Apparatus for the Construction of Bore-holes and Shafts of every description in Mining Installations", desire to enter into negotiations with a firm or firms for the sale of the patent or for the grant of licences thereunder. Further particulars may be obtained from Marks and Clerk, 57 and 58 Lincoln's Inn Fields, London, W.C.2.

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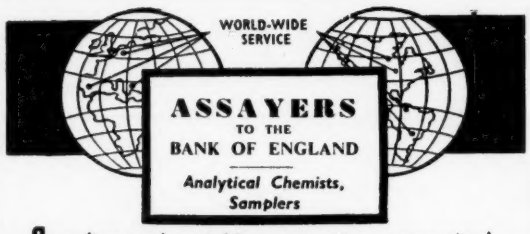

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MAP OF THE KLERKSDORP FIELD

★While a mine is at the development stage, it is of vital importance to have a visual picture of its position in relation to the field as a whole. Otherwise the quarterly results published by the companies lose much of their significance.

★Results reported from adjacent mines often have a direct bearing on the one in which you are interested, which, however, can only become apparent if you have clearly in mind the position of all the properties in relation to one another.

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—what shafts are being sunk, how far they have gone and what the final depth is expected to be.

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LONDON METAL AND ORE PRICES, DEC. 31, 1959

METAL PRICES

Aluminium, 99.5%, £180/£186 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £190 per ton
Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom.
Cadmium 10s. 0d lb.
Cerium (99%) net, £16 0s. lb. delivered U.K.
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.
Cobalt, 14s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 5d. per gram
Gold, 250s. 6¼d.
Iridium, £23/£25 oz. nom.
Lanthanum (98%/99%) 15s. per gram.
Manganese Metal (96%/98%) £245/£250
Magnesium, 2s. 0d./2s. 3d. lb.
Nickel, 99.5% (home trade) £600 per ton
Osmium, £21/£23 oz. nom.
Osmiridium, nom.
Palladium, £8 12s. 6d.
Platinum U.K. and Empire Refined £28 10s. oz.
Imported £27/£27¼
Quicksilver, £71½/£72 ex-warehouse
Rhodium, £41/£45 oz.
Ruthenium, £18/£20 oz. nom.
Selenium, 50s. 0d. per lb.
Silver, 80½d. f. oz. spot and 79½d. f'd
Tellurium, 18s. lb.

ORES AND OXIDES

Antimony Ore (60%) basis	20s. 0d./22s. 0d. per unit, c.i.f.
Beryl (min. 10 per cent BeO)	250s. per l. ton unit BeO
Bismuth	30% 5s. 0d. lb. c.i.f.
	20% 3s. 3d. lb. c.i.f.
Chrome Ore—	
Rhodesian Metallurgical (semifriable 48% (Ratio 3 : 1)	£15 15s. 0d. per ton c.i.f.
,, Hard Lumpy 45% (Ratio 3 : 1)	£15 10s. 0d. per ton c.i.f.
,, Refractory 40%	£11 0s. 0d. per ton c.i.f.
,, Smalls 44% (Ratio 3 : 1)	£14 0s. 0d. per ton c.i.f.
Baluchistan 48% (Ratio 3 : 1)	£11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10 : 1). Nb_2O_5:Ta_2O_5	175s. per l. ton unit c.i.f.
Fluorspar—	
Acid Grade, Flotated Material	£22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF_2)	156s. 0d. ex. works
Lithium Ore—	
Petalite min. 3½% Li_2O	40s. 0d./45s. 0d. per unit f.o.b. Beira
Lepidolite min. 3½% Li_2O	40s. 0d./45s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O	£25 0s. per ton f.o.b. Beira
Magnesite, ground calcined	£28 0s./£30 0s. d/d
Magnesite Raw (ground)	£21 0s./£23 0s. d/d
Manganese Ore Indian—	
Europe (46%-48%) basis 6/s. 6d. freight	73d./75d. c.i.f. nom.
Manganese Ore (43%-45%)	69d./71d. c.i.f. nom.
Manganese Ore (38%-40%)	nom.
Molybdenite (85%) basis	8s. 11d. per lb. (f.o.b.)
Titanium Ore—	
Rutile 95/97% TiO_2 (prompt delivery)	£29 per ton c.i.f. Aust'n.
Ilmenite 52/54% TiO_2	£11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%)	147s. 0d./152s. 0d. per unit c.i.f.
Vanadium—	
Fused oxide 95% V_2O_5	8s./8s. 11d. per lb. V_2O_5 c.i.f.
Zircon Sand (Australian) 65-66% ZrO_2	£16/£16 10s. ton c.i.f.

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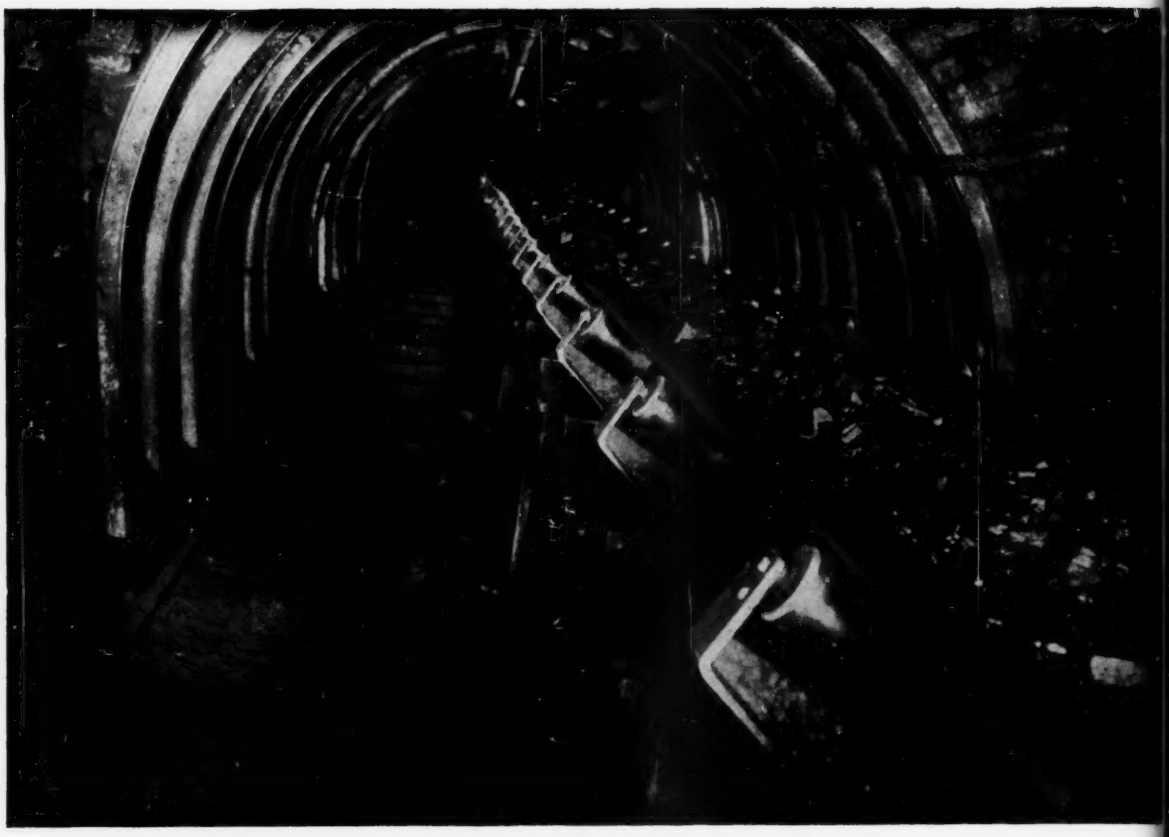

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